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ABSTRACT

This is a report on the status of computer-assisted instruction (CAI) networked systems utilizing microcomputer technology at the end of the 1987-88 school year, the first year of CAI network implementation in the public schools of Hawaii. Data for the study were collected via: site visitations to 12 of the 19 networked CAI schools; interviews; and two survey questionnaires, one pertaining to implementation and the other to end user perceptions. Each of the 19 CAI networked laboratories identified was analyzed in terms of its merits and shortcomings, its purpose and scope, and its quality in content and delivery. Responses to the questionnaires indicated that the target population included children from kindergarten through grade 12 in both regular and special programs, and that CAI lessons were often used for normal developmental and enrichment purposes as well as remediation. Furthermore, CAI network systems were viewed by teachers as being a viable, effective tool when used as a supplement to traditional instruction. Crucial ingredients in establishing and operating a successful CAI networked learning environment were identified as: (1) planning, coordination, and resource management; (2) appropriate selection of target students; and (3) training and preparation of school staff in implementing CAI programs. Ten figures and 15 tables supplement the text, and the two questionnaires are appended. (14 references) (SD)

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COMPUTER-ASSISTED INSTRUCTION

NETWORK SYSTEMS

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Preliminary Findings on First Year State-wide Implementation in Hawaii Public Education

November 1988

Department of Education
Office of the Superintendent
Planning and Evaluation Branch, Evaluation Section

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Executive Summary

I. Introduction

This is a status report on the first year of computer-assisted instruction (CAI) networked systems implemented in the Hawaii State Department of Education, school year (SY) 1987-88. Computer-based instruction (CBI) is a generic referent to computer software programs that impart instruction, provide information, and at times, issue corrective feedback to the user(s). Subsumed under CBI is computer-assisted instruction, or simply CAI, a similar, related construct that pertains to computer generated presentations and prompts that guide learning outcomes. Such CAI programs come in many forms, but are typically classified in categories such as "drill and practice," "tutorial," or "simulation." Computer-managed Instruction, or CMI, is another related construct that refers more specifically to the monitoring, guiding, and restructuring of a student's learning experience. The CMI program is not necessarily linked to CAI, although it is a feasible, useful, and increasingly frequent incorporated feature. Finally, "networked" systems are simply two or more computers connected by some electronic means to allow sharing of programs, hard drives and peripheral devices such as printers and optical discs (e.g., CD-ROM).

II. Background

A. An Historical Perspective

Networked CAI systems utilizing microcomputer technology are a relatively new phenomenon to the educational community. With the recent introduction and improvement of local area networked (LAN) technology, the computer industry has been able to incorporate approaches from several frontiers that enable the linkage of dozens of microcomputers to a host "file server" (typically another, larger microcomputer) that manages the retrieval and storage of information for each "work station" microcomputer while simultaneously monitoring and saving information on the performance of each individual user. Early CAI programs in the 1960's-70's such as the University of Illinois developed PLATO, had typically utilized a large mainframe or medium-sized computer to handle the enormous storage capacity and numerous tasks required by computer-based education systems. During the late 1970's and early 1980's the advent of the microcomputer technology enabled "stand-alone" microcomputers to run many newly developed CAI programs that covered numerous topics that ranged from simple drill and practice arithmetic problems to more sophisticated simulation of experiments in chemistry and physics. The use of microcomputers also instituted an element of flexible utility not possible with dedicated computer terminals.

B. Program Overview

The implementation of CAI and CAI network systems reflects one of four major areas slated for the Computers in Instruction Program as outlined in the State of Hawaii, Department of Education (DOE) Plans for Computers in Education (1984). The other three areas include computer literacy, computer-based information retrieval, and computer-managed instruction. CAI is defined therein, as "...a learning environment in which the computer presents instructional material to the student in an interactive mode using drill and practice, tutorial, and simulation programs."

Networked CAI systems are equipped with an additional dimension: work stations are connected together and linked to a host computer (i.e., file server). This enabling technology allows for a potentially efficient system of computers capable of simultaneously managing files and processing information relevant to each individual network user. The latter capability often is conceived as computer-managed instruction (CMI), a promising adjunct tool for the classroom teacher. With CMI, information on each student's progress can be systematically stored, retrieved and analyzed by the teacher through the use of computer generated individual or class reports.

The first CAI programs appeared in Hawaii's public schools in the early 1980's. It was only recently, however, that lower costs and improvements in microcomputer local area network technology made it feasible for large-scale marketing of CAI network systems. In SY 1987-88, all seven of Hawaii's school districts were afforded the opportunity to install, on a trial basis, at least one of several available CAI networked systems. The CAI network systems selected by districts for field-testing included:

(1) Computer Curriculum Corporation (CCC), Palo Alto, CA
(2) Educational Systems Corporation (ESC), San Diego, CA
(3) International Business Machines (IBM), Atlanta, GA
(4) PLATO, Minneapolis, MN
(5) Prescription Learning Corporation (PLC), Phoenix, AZ
(6) Tandy, Fort Worth, TX

C. Previous Research Findings

In a recent article reviewing microcomputer use in education, Bozeman and House (1988) conclude that although "...the literature is replete with research concerning computer-based instruction effectiveness, ...findings are inconclusive and often contradictory" (p. 83). There are at least two primary reasons for this state of affairs. First is the proliferation of CBI software. It was several years ago that Komolski (1985) pointed out that the CBI selection included some 10,000 packages produced by approximately 700 educational software publishers. In addition to the breadth of software, there is a problem of comparing studies in a rapidly evolving and changing field. Second, much of the

research effort may be faulted for poor design, methodological problems, or limitations that deter one from resolving the long-standing question of CBI effectiveness. Becker (1987) conducted a comprehensive analysis of research on CBI effectiveness and concluded that "..existing evidence of computer effectiveness is scanty, and existing studies provide little guidance for schools to decide how to use computers for instruction."

In contrast to the abundant literature on CAI, CAI network systems, a relatively new technological innovation, is not characterized by a plethora of research. It will probably take several years hence to adequately assess, with any degree of confidence, any long-standing effects of particular features of networked CAI. On the other hand, there are more similarities than differences between CAI and networked CAI. Just how critical a role these differences play in influencing student learning outcomes is a question that needs to be addressed. Schools are currently implementing several different types of CAI network systems with quite different configurations and organizational patterns. Some systems have attempted to integrate a network of CAI with CMI, others incorporate multiple input or output devices. What may be said of one system may not at all be applicable to another. This certainly is a field in critical need of further evaluation or research, particularly in light of the potential costs of networked systems.

III. Evaluation Plan

A. Purpose and Goal

The present evaluation is an examination of networked CAI systems only. The purpose of this evaluation is of a formative nature, with a focus on CAI network systems that have been implemented in Hawaii's public schools during school year 1987-88. The goal is to provide documentation and evidence on what components and services are found to be essential to successful networked systems. There is a critical need, at present, for data on computer-based instruction that will allow school administrators and staff to review existing options, practices and funding. An information base of CAI related research coupled with profile descriptions of available CAI network systems is a step towards filling the knowledge gap experienced by school administrators faced with decisions on how best to utilize limited resources for computer-based instruction. No attempt will be made here to assess the long-range impact of CAI networks on student achievement, although some preliminary planning by districts for such an anticipated need is suggested.

B. Design

The evaluation is designed to: (1) document results of a limited state-wide field test of CAI network systems; (2) provide profile descriptions of CAI network systems in operation at Hawaii public school

sites; (3) identify evaluation potential for further assessment of networked CAI effectiveness; (4) examine similarities and differences among existing CAI network systems, and (5) assist in determining what characteristics or components are essential to a "successful" CAI network system. "Success" here may be defined with respect to usefulness and quality of the system as perceived by end-users, specifically teachers.

The design consisted of site visitations, interviews, and two survey questionnaires, one pertaining to implementation and the other to end-user perceptions. An attempt was also made to establish baseline information with regard to implementation levels and effectiveness ratings. Information derived through the evaluation should be of particular value to state, district, and school decision-makers who are responsible for directing the future of computer-based education in Hawaii. Each individual CAI network is analyzed in terms of its merits and shortcomings, for its purpose and scope, and for its quality in content and delivery.

C. Procedures

Evaluation plans were first developed to determine scope and sequence of the CAI network system review. Initial feedback was solicited from district and state computer education coordinators with respect to evaluation focus, target groups and design. Two survey instruments, Implementation Survey and User Survey: Teacher, were subsequently developed and then reviewed by district and state specialists responsible for computer education in Hawaii. Several items in the draft surveys were then revised prior to actual administration.

Surveys were administered in the second semester of SY 1987-88. All 19 networked CAI school sites were asked to participate in the Implementation Survey. The User Survey: Teacher was also distributed to all teachers at the same sites, except for three intermediate schools. Three Honolulu district intermediate schools had acquired the Computer Curriculum Corporation (CCC) CAI network in early January. Teachers at these CCC sites did not have an opportunity to sufficiently observe students utilizing the newly installed CAI network system. Information was available, however, on installation and operational aspects of CCC.

On-site visits were conducted at 12 of the 19 networked CAI schools. It was not economically feasible to observe CAI sessions at all school sites. Where site visits were made, the evaluator observed lab operations and interviewed available staff which included principals, teachers, students, lab attendants/coordinators and district specialists who served as computer education coordinators. Data were also obtained via telephone interviews with staff located on neighbor islands.

IV. Findings and Recommendations

A. Implementation

A review of statewide computer facilities available in Hawaii public schools conducted in spring 1988 produced an initial list of seven different types of CAI network laboratories. One of the initial seven types of CAI network labs identified in spring 1988 (i.e., Ideal Learning) was not fully installed during SY 1987-88. As a consequence, there were a total of six different types of CAI network laboratories included in the present evaluation study.

Organizationally, the establishment of pilot CAI network lab efforts was headed by the state educational specialist for computer education, in conjunction with the administrative staff of the Office of Instructional Services. Each district, in turn, had a counterpart who worked cooperatively with CAI vendors to procure, install, operate and maintain network labs. These district educational specialists responsible for computer education assisted each networked lab school site in start-up activities and implementation strategies. Typically, however, administrators at each school site made day-to-day operational decisions independently of one another.

Operationally, most schools opted for an emphasis on math and reading CAI lessons, but a few expanded on other curriculum areas (e.g., business) or application programs such as wordprocessing and database management systems.

A grand total of 19 CAI networked labs were identified in the present study. These CAI networked systems were primarily supported through state funds. On the other hand, data from other CAI network system laboratories, specifically those funded through ECIA Chapter 1, were not available from some of the seven districts. The target population of students utilizing CAI programs included students in regular as well as special programs. These included both boys and girls at various grade levels (kindergarten to grade 12). In addition to variability in subject areas covered, CAI lessons were often used for normal developmental and enrichment as well as remediation purposes.

The following is a list of the SY 1987-88 CAI network systems, by CAI proprietorship.

CAI NETWORK SYSTEMS

	SCHOOL	CAI PROPRIETORSHIP
1.	Jarrett Intermediate	Computer Curriculum Corp. (CCC)
2.	Stevenson Intermediate	CCC
3.	Washington Intermediate	CCC
4.	Ahuimanu Elementary	Educational Systems Corp. (ESC)
5.	Kahaluu Elementary	ESC
6.	Kalaheo Elementary	ESC
7.	Nanakuli Elementary	ESC
8.	Laupahoehoe High and Elementary	International Business Machines (IBM)
9.	Mililani High	IBM
10.	Farrington High	PLATO
11.	Aiea High	Prescription Learning Corp. (PLC)
12.	Castle High	PLC
13.	Enchanted Lake Elementary	PLC
14.	King Kamehameha III Elementary	PLC
15.	Lihikai Elementary	PLC
16.	McKinley High	PLC
17.	Pukalani Elementary	PLC
18.	Kalakaua Intermediate	Tandy
19.	Lanai High and Elementary	Tandy

Results of the Implementation Survey

Eighteen of the 19 schools contacted for participation in the Implementation Survey returned the survey instrument (95% return rate) which contained items on hardware, software, operations, costs, training, and planning and evaluation activities.

All systems were equipped with a single file server. The CCC network system was the only system that linked workstations across schools as well as across workstations within a school. The size of the CAI network systems, essentially defined as the number of operating workstations, ranged from 9 (Kalakaua Intermediate) to 32 (Nanakuli Elementary and Lanai High and Elementary).

All 18 school sites focus on "basic skills." Five sites (28%) also identified "regular curriculum" as an additional focus area. With respect to the purpose of CAI networks, 83% (n=15) of the schools indicated "remediation," 67% (n=12) indicated "normal

developmental," and 39% (n=7) indicated "enrichment" (duplicated counts).

None of the schools reported that any significant problems were experienced during installation of the CAI network. Five schools (28%), however, from three different systems indicated that the installation was not promptly completed. Most schools considered vendor support to be adequate; one school was not sure, another indicated support was not adequate and still another replied that vendor support was not available at all.

Cost estimates were difficult to determine due to differences in type and length of contractual agreements. The specificity of contractual agreements also varied widely among the network systems. Differences were also found in contract content within a network system that operated at multiple school sites (e.g., PLC).

Total costs (over five years) ranged from a low of $3,400 for a 32-workstation Tandy system at Lanai High and Elementary, to a high of $290,000 for a 32-workstation ESC system at Nanakuli Elementary. Much of Lanai's network system was donated by Tandy Corporation, whereas the ESC system at Nanakuli included state-of-the-art components, courseware updating, and provisions for a lab attendant. The mean (average) total cost for all systems was slightly more than $124,200.

The most important figures, perhaps, are the average annual cost per workstation. These estimates ranged from a low of $21 (Tandy-Lanai) to $1,958 (ESC-Ahuimanu, Kahaluu) per workstation, per year. The mean (average) annual cost per workstation was approximately $1,150.

Though all of the schools reported that teacher in-service training was conducted, there were vast differences in the numbers trained, the source of training and the extent of training received. Seventy-two percent of the schools (n=13) stated they either needed or were unsure if they needed further training. Examples of training needs ranged from basic understanding of the CAI network capabilities, to trouble-shooting, to assistance in integrating the courseware with classroom activities.

Finally, information on preparatory steps essential to subsequent evaluation efforts was obtained for each school site. A cautionary note may be in order here. Although many of the responses to the direct inquiries into planning and evaluation were in the affirmative, the response patterns were often indicative of inconsistencies or uncertainty.

A significant, general need, in terms of planning and evaluation of CAI network systems, is program-wide planning for assessment of CAI impact. Without systematic, designed evaluations with some control over the numerous variables that influence student outcome

and simultaneously interact with one another, it is virtually impossible to deduce which sources contributed to what extent in improving student performance.

B. Perceptions of Effect

Results of the User Survey: Teacher

The analyses of responses from the entire sample of 177 teachers reveal that, in general, CAI network systems started in Hawaii public schools during SY 1987-88 are seen as a viable, effective tool when used as a supplement to traditional instruction. The most salient advantage of the CAI network system is the ability to provide individual, self-paced instruction with a level of novelty that increases student interest and motivation to learn.

With respect to implementation concerns, several findings merit discussion. First, a sizeable portion of teachers indicate they either are feeling uncomfortable or are unsure if they are uncomfortable (42%). This would help explain why so few teachers utilize the CAI features regularly, and why so many teachers report they need assistance in utilizing CMI features (74%) or in integrating CAI courseware with instructional curricula (65%).

Second, an overwhelming proportion of teachers use the CAI to supplement classroom instruction (99%). Only one teacher reported using the CAI solely for replacement purposes. Third, teachers most often use the CAI for remediation of basic skills or for normal developmental instructional activities. Still, over a third of the teachers use these CAI lessons for enrichment activities as well.

Finally, although a majority of the teachers indicated that outcome measures such as the (network system's) tests or quizzes seem appropriate, almost a third are either unsure or do not feel such measures are adequate or appropriate. These results are consistent with the responses in the Implementation Survey, where information on which outcome measures have been identified are often sketchy or non-existent. Ironically, though the importance of discussing the value of the CAI impact is most certainly a priority item, the components needed to conduct such as assessments are largely overlooked or postponed.

In summary, results of analyses involving all CAI network systems suggest that, in general, teachers are favorable to utilizing CAI network systems, but problems inherent in any new program, particularly in a start-up year, need to be resolved. These problems typically involve implementation activities: training, preparation, coordination, proper staffing, support services, etc. Moreover, in many situations, human resources constitute a key factor. Specifically, the teacher survey results have identified at least two major areas in which teachers need assistance:

(1) integration with existing curricula, and

(2) proper use of CMI features.

D. Recommendations

1. Re-double efforts to carefully **plan and coordinate** future implementation of CAI network systems. Schools need an explicit, strong support system, with continuity in planning.

2. Encourage the use of **lab attendants**, especially if a teacher or educational aide position is not assigned to the lab as support staff.

(3) Use networked CAI primarily, if not exclusively, as **supplemental instruction**. CAI seems best when used to complement text, materials, and classroom activities. Teachers should accompany their students where possible to gain insights into how best to use the CAI and CMI programs to students' advantage.

(4) Provide **training** opportunities for staff, especially for teachers to learn more about the system's capabilities via CMI to monitor performance and individualize instruction based on students' strengths and weaknesses. More efficient use of CMI is needed to maximize the potential of CAI.

(5) Encourage schools to explore how best to **integrate** networked CAI activities with classroom instruction.

(6) Consider establishment of a **study team** or contracting **independent reviewers** to assist in content analysis of scope, depth and quality of existing CAI courseware, and consistency with Hawaii's curriculum foci.

(7) **Directions** for CAI networks may best be guided by what schools need. Look into possibilities such as developing networked CAI curricula designed to assist in passing minimum competency tests (e.g., HSTEC). (cf, Washington State's agreement with ESC to develop special CAI lessons [simulations] based on curriculum specialists' help in Washington's schools)

(8) Continue to **research** CAI network systems. The current market is characterized by marked improvements in CAI content and delivery. It may not be wise to depend solely on familiar brand names.

V. CONCLUSIONS

1. What **ingredients** appear to be **crucial** in establishing and operating a "successful" CAI network learning environment? This is a difficult question to address straightforwardly, but some preliminary analyses do point to key elements essential to accomplishing an efficient network system.

   a. Most important of all is management. Proper planning, coordination and resource management, are crucial to operational efficiency.

   b. Another general category of items that lay the foundations for successful CAI network systems include operational features. The selection of target students is the precursor to other decisions that need to be made appropriately. Goals and objectives should guide decisions resulting in which systems with what support staff, and conditions under which networked CAI is implemented.

   c. Finally, but not necessarily least in importance, are training opportunities and the need to properly prepare school staff in implementing CAI network systems. It cannot be emphasized enough, it seems, that adequate training is a sine qua non for maximizing teacher involvement and commitment as well as expertise. The full potential of CAI network systems will not be efficiently tapped without providing teachers the insights and support needed to enhance student learning experiences.

2. The six types of CAI network systems field-tested in Hawaii public schools during SY 1987-88 were characterized by prominent differences in hardware configuration, lab size, cost, contract arrangement and operation. The intent and focus of these systems also varied from site to site.

3. Virtually all of these network systems were new and installed by the respective vendors at 19 selected school sites across Hawaii's seven public school districts. Installation was successful at all school sites, but a number of schools reported delays in installing either the hardware or instructional software. In general, the implementation of these network systems can be characterized by similarity in network concept (single file server linked to multiple workstations), but vast differences abound with respect to coordination, schedule, use of CMI features, target students, courseware delivery, and management of lab operations.

4. Although the descriptions of CAI network systems, as exemplified through the profile sheets, are more different than similar in many ways, the ratings by teachers of CAI benefits and effectiveness are not always measurably distinctive. Most teachers are clearly in

favor of the CAI concept and of attempts to reap benefits of CAI not possible with traditional classroom environments. What remains unclear, though, are differences in the quality of CAI programs. What is not available, at present, is a systematic review of courseware quality and comparative worth of individual network systems with respect to delivery, learning outcomes and cost-effectiveness.

5. Numerous problems were experienced by schools in the start-up activities of this first year of implementation. Many of these problems were possibly due to the limited time made available to district and school staff for proper planning and preparation in instituting a new program. The extent to which each school was successful in utilizing the full potential of the CAI/CMI system is unknown, but it is probably safe to say that none of the schools has extensively tapped the capabilities of CAI network systems.

6. What general observations then, can be made after the conclusion of the initial year of implementation? Perhaps the most general statement that could be made is that CAI network systems are operating at all school sites with the exception of Mililani High, whose apparent objective was to deliberately omit CAI as the primary intent of the networked lab. Goals and objectives need to be clearly conveyed to all support personnel. Training should be provided, based on each school's identified needs. Planning and preparation activities need to be coordinated among policy-making agents (e.g., Computers In Education committee), managing agents (e.g., state and district personnel), and implementing agents (e.g., teacher, lab coordinators).

7. How extensive are planning and evaluation preparations at school sites? Very frankly, clear conclusions as to the relative impact and effectiveness will be difficult to obtain under present conditions. There are few schools with clear objectives and explicit outcome measures or data collection procedures. No overall design is reflected in the implementation scheme. Even the entire body of CAI research provides little with respect to unequivocal findings based on sound, vigorous methodology. Networked CAI too, is relatively new, and data from independent sources will not be forthcoming for some time.

8. The common element that threads through all forms of CAI is the attempt to provide a viable instructional or training strategy that may complement existing educational approaches. CAI is capable of providing what is impossible for the typical classroom teacher who rarely is afforded the opportunity to furnish individual instruction to each student. It is economically unfeasible to secure one-to-one tutelage, and not even desirable for certain learning experiences. However, when the need does arise, the CAI approach is an alternative increasingly sought and utilized.

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Computer-Assisted Instruction Networked Systems: Preliminary Findings on First Year State-wide Implementation in Hawaii Public Education

I. Introduction

This is a status report on the first year of computer-assisted instruction (CAI) networked systems implemented in the Hawaii State Department of Education, school year (SY) 1987-88. There are several terms and concepts that are best introduced here. Computer-based instruction (CBI) is a generic referent to computer software programs that impart instruction, provide information, and at times, issue corrective feedback to the user(s). Subsumed under CBI is computer-assisted instruction, or simply CAI, a similar, related construct that pertains to computer generated presentations and prompts that guide learning outcomes. Such CAI programs come in many forms, but are typically classified in categories such as "drill and practice," "tutorial," or "simulation." Computer-managed Instruction, or CMI, is another related construct that refers more specifically to the monitoring, guiding, and restructuring of a student's learning experience. The CMI program is not necessarily linked to CAI, although it is a feasible, useful, and increasingly frequent incorporated feature. Finally, "networked" systems are simply two or more computers connected by some electronic means to allow sharing of programs, hard drives and peripheral devices such as printers and optical discs (e.g., CD-ROM).

II. Background

A. An Historical Perspective

The use of a computer as an educational tool has a short but illustrious history with roots that trace back to the invention of the teaching machine. Although the concept and purpose of the teaching machine as an educational aid was important, its utility was short-lived. It was a definite mismatch as an alternative instructional strategy and a sorely inadequate substitute for more traditional teaching methods. On the other hand, there are strong indications that the circumstances surrounding the development of computer-assisted instruction will dictate a far different destiny for the computer as an instructional delivery tool. It now has been more than a decade since the first microcomputer was used in an American classroom, and more than two decades since large or mid-range type computers were applied in an instructional delivery setting (Bozeman and House, 1988).

In contrast, networked CAI systems utilizing microcomputer technology are a relatively new phenomenon to the educational community. With the recent introduction and improvement of local area

networked (LAN) technology, the computer industry has been able to incorporate approaches from several frontiers that enable the linkage of dozens of microcomputers to a host "file server" (typically another, larger microcomputer) that manages the retrieval and storage of information for each "work station" microcomputer while simultaneously monitoring and saving information on the performance of each individual user. Early CAI programs in the 1960's-70's, such as the University of Illinois' PLATO, had typically utilized a large mainframe or medium-sized computer to handle the enormous storage capacity and numerous tasks required by computer-based education systems. During the late 1970's and early 1980's the advent of the microcomputer technology enabled "stand-alone" microcomputers to run many newly developed CAI programs that covered numerous topics ranging from simple drill and practice arithmetic problems to more sophisticated simulation of experiments in chemistry and physics. The use of microcomputers also instituted an element of flexible utility not possible with dedicated computer terminals.

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Networked CAI systems are equipped with an additional dimension: work stations are connected together and linked to a host computer (i.e., file server). This enabling technology allows for a potentially efficient system of computers capable of simultaneously managing files and processing information relevant to each individual network user. The latter capability often is conceived as computer-managed instruction (CMI), a promising adjunct tool for the classroom teacher. With CMI, information on each student's progress can be systematically stored, retrieved and analyzed by the teacher through the use of computer generated individual or class reports.

The first CAI programs appeared in Hawaii's public schools in the early 1980's. It was only recently, however, that lower costs and improvements in microcomputer local area network technology made it feasible for large-scale marketing of CAI network systems. In SY 1987-88, all seven of Hawaii's school districts were afforded the opportunity to install, on a trial basis, at least one of several available CAI networked systems. The CAI network systems selected by districts for field-testing included:

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(5) Prescription Learning Corporation (PLC), Phoenix, AZ
(6) Tandy, Fort Worth, TX

All except CCC were operational by Fall 1987. CCC started operating in January 1988 (second semester). Each CAI network system was installed at a school site, typically with an educational aide hired specifically to serve as lab assistant, or a teacher assigned to provide general coordination. District educational specialists were to provide support services such as procurement arrangements and technical assistance. Although the state educational specialist for computers in education was responsible for providing assistance in planning, installing, and general coordination for all CAI network systems, the position was vacant in Fall 1987.

C. Previous Research Findings

In a recent article reviewing microcomputer use in education, Bozeman and House (1988) conclude that although "...the literature is replete with research concerning computer-based instruction[1] effectiveness, ...findings are inconclusive and often contradictory" (p. 83). There are at least two primary reasons for this state of affairs. First is the proliferation of CBI software. It was several years ago that Komolski (1985) pointed out that the CBI selection included some 10,000 packages produced by approximately 700 educational software publishers. In addition to the breadth of software, there is a problem of comparing studies in a rapidly evolving and changing field. Second, much of the research effort may be faulted for poor design, methodological problems, or limitations that deter one from resolving the long-standing question of CBI effectiveness. Becker (1987) conducted a comprehensive analysis of research on CBI effectiveness and concluded that "..existing evidence of computer effectiveness is scanty, and existing studies provide little guidance for schools to decide how to use computers for instruction."

At present, there simply are few general statements that can be confidently made with regard to instructional efficiency, learning retention, and cost-effectiveness. Student achievement seems to be a function of numerous factors, some of which overlap or interact to provide distinctive differences in effect size and in some cases, even direction of learning outcome. To compound the confusion, few studies have provided the level of detail necessary to ascertain the specific

[1] Computer-based instruction (CBI) is defined by Bozeman and House (1988) as a generic term that refers to a curricular program with an interaction between students and computer, and instructional delivery in the form of drill and practice, tutorial, games and problem-solving (p. 83).

nature of the CBI and the context in which it was applied. Operational definitions of CAI effectiveness, for example, depend on the type of indicators utilized to measure impact. Typically, standardized achievement tests are selected as dependent measures, but it should be clear that such instruments serve as only one of many potentially useful indicators of program impact. Nor are achievement measures without limitations in an attempt to infer progress or improvement. In a recent publication on computer use and student achievement, the Harvard Education Letter (1988) cautioned educators to beware of equating standard achievement scores with student achievement, especially in instances where the computer is used as a tool for inquiry, as opposed to an adjunct to instruction.

In contrast to the abundant literature on CAI, CAI network systems, a relatively new technological innovation, is not characterized by a plethora of research. It will probably take several years hence to adequately assess, with any degree of confidence, any long-standing effects of particular features of networked CAI. On the other hand, there are more similarities than differences between CAI and networked CAI. Just how critical a role these differences play in influencing student learning outcomes is a question that needs to be addressed. Schools are currently implementing several different types of CAI network systems with quite different configurations and organizational patterns. Some systems have attempted to integrate a network of CAI with CMI, others incorporate multiple input or output devices. What may be said of one system may not at all be applicable to another. This certainly is a field in critical need of further evaluation or research, particularly in light of the potential costs of networked systems.

What then may be said of CAI or CAI networks? In spite of vast differences in hardware configurations, courseware content, student populations, implementation practices, and research methodology, studies do seem generally positive in their findings. Several researchers have utilized meta-analytic approaches in an attempt to integrate findings from an assortment of independent evaluations. In general, such studies have found that students seem to improve both retention and speed in learning (e.g., Kulik, Bangert and Williams, 1983). With respect to tutorial CAI, an area of primary interest in the present evaluation, there is a large and growing body of literature. Although results are mixed, the use of CAI has usually produced higher achievement than conventional instruction (Edwards et al., 1975; Thomas 1979; Burns and Bozeman, 1981; and Kulik et al., 1983). Moreover, the costs for CAI are more than for conventional instruction, but CAI appears more cost-effective when, for example, math achievement is factored into the cost analysis (Ash 1986). And still another area of primary interest concerns the scope and depth of CAI's role in education. In this regard, the importance of integrating computers with on-going curriculum has been underscored by Suydam (1986) in a review of research on computers in mathematics education under contract with the Office of Educational Research and Improvement, U.S. Department of Education.

More specifically, McDermott (1985) has outlined nine general conclusions which, in his opinion, have emerged "with enough regularity" from research conducted nationally during the period 1962-1985.[2] This research, which spans two-and-a-half decades, has centered on CAI and CAI-CMI, without an attempt to isolate the effects of CMI.

1. CAI is most successful in helping learners attain clearly specified objectives, especially in the basic skill areas.

2. CAI saves significant amounts of time over "conventional instruction," as much as 20 to 40 percent.

3. Retention rates following CAI are at least as good as, and are often better than, retention following conventional instruction.

4. Students have positive attitudes toward good CAI programs and dislike poor programs, especially those over which they have no control.

5. The appropriate instructional time for CAI from a learner, administrative and classroom management standpoint is 12-20 minutes on task four days a week in a given subject.

6. Tutorial - drill - practice CAI are effective types of courseware. Courseware incorporating both Behavioral and Gestalt psychological principles increase effectiveness.

7. Achievement gains in reading are about 70% of the gains in mathematics when instruction is supplemented with basic skills CAI.

8. Supplemental CAI seems to result in greater gains more frequently than CAI lessons substituted for regular lessons.

9. Students using computers have positive attitudes toward ease of use and about learning through the use of a computer or terminal.

Other, related conclusions drawn by researchers include:

- Extensive teacher in-service needs exist due to limited computer exposure in faculty members' formal training.

- Implementation of CMI systems need to be preceded by in-depth training on the part of all instructional staff, principals, and key administrators.

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[2]A cautionary caveat is necessary here to point out the importance of distinguishing between "regularity" and "validity" of findings. Consistent, reliable results are necessary, but do not, in themselves, imply validity.

- o Effective use of CMI for diagnosis and prescription of learning activities requires extensive teacher involvement to meet specific local needs.

- o Potential for computer use is good for both gifted and handicapped students.

- o Socioeconomic status of schools and student-computer ratio influence the success of implementing a computer curriculum.

- o The subject areas where CAI has been most effective are science, foreign language, mathematics, reading, and language arts.

- o Actual achievement gains exceed expected gains when based on knowledge of students' prior performance.

- o CAI is most effective when it is used as supplementary instruction.

- o Learning, particularly in math, can be enhanced when instructional environments are supplemented by CAI.

- o Other non-computer strategies such as peer group, adult tutors, instructional television and teacher in-service training in which improved methods of instruction also produce significant results.

In Hawaii, there are at least two reports on CAI worthy of mention. The first, entitled CAI Report (1986), is a review by the Hawaii State Department of Education documenting available information on CAI research and practices both nationally and within the State of Hawaii. In sum, the Department of Education CAI report issued statements on major findings on training and support, software, equipment, effectiveness, and target population. The major conclusion from the review was that CAI ought to be initiated gradually, with caution, and that careful planning is a sine qua non. Recommendations include:

(1) conducting in-service training prior to CAI implementation and providing follow-up support services;
(2) use CAI to augment services provided through special programs;
(3) use CAI to support basic skills instruction in mathematics and language arts; and
(4) permit controlled use of CAI in other areas such as word processing in writing, database management in social sciences, and graphics in art.

The second report summarizes results of an evaluation study of the Hawaii State DOE's SY 1985-86 CAI project conducted by the University of Hawaii, Curriculum Research and Development Group (Saka & Lai, 1986). The evaluation consisted of reviewing existing CAI literature, assessing student performance on computer literacy topics, conducting

classroom observations, and measuring student attitudes toward computer use. Results of Saka & Lai's study have been incorporated into CAI-related DOE documents such as the Hawaii State DOE CAI Report mentioned above and the CAI Implementation Guideline (circa 1987). Consistent with the review prepared by Suydam (1986), Saka & Lai observed that despite being highly qualified in their respective subject areas, teachers often found it difficult to integrate computer courseware with classroom curricula. Recommendations stemming from the evaluation findings included more support to teachers in integrating CAI with curriculum, use of a lab assistant where economically feasible, and use of simulation and problem-solving modes of CAI over drill and practice whenever quality software was available, especially at the secondary level.

In summary, two-and-a-half decades of research on CBI, and CAI, in particular, have produced three main sources of evidence about the effects of school instructional uses of computers on student achievement:

(1) national and local surveys of school uses of computers;
(2) experimental studies of the effects of computer-based instruction; and
(3) research reviews of previous studies on the effectiveness of CAI.

Despite the large body of research available on CBI and CAI, there is scant evidence of computer effectiveness from well-designed, methodologically sound studies. Findings from existing studies provide little guidance for schools to decide how to use computers for instruction. Few studies pertain to long-term learning outcomes, and are free from methodological flaws. It's difficult to tell in many instances to what extent a Hawthorne effect might be operative. Innovative methods such as meta-analysis have been utilized in an attempt to integrate the research, but even sophisticated statistical procedures cannot undo all the problems that stem from poor designs. There are some general conclusions that can be drawn from the available research, some of which may be stated with a fair degree of confidence based on the consistancy of findings, but much too often results are disseminated without sufficient detail on context and procedures.

Compounding the difficulty is the rapid growth and change in CBI. For example, there has been a phenomenal metamorphosis in the delivery and characteristics of CAI. Much of the literature appears to be outdated as a vastly different CAI environment has evolved in recent years. CAI is now often networked and integrated with, instead of contrasted with CMI.

By comparison, the perceptions of educators seem more convergent than results of experimental studies. Perceived **benefits** of CBI, for example, have been identified mainly in four areas: student motivation, student cooperation and independence, opportunities for high-ability students in programming and in other higher-order thinking skills, and opportunities for low-ability students to master basic math and language arts skills. Perceived **problems** are identified as well. There seems to be

an important and recurring need for teacher and support staff in-service training. Some teachers express reservations, experience fear and may be reluctant to participate in new CBI projects.

Finally, the importance of process evaluation needs to be underscored (Bozeman & House 1988). Both research and evaluation studies need to focus first on how well CAI programs are actually implemented. Such formative studies can be an enormous asset to computer-based projects. Further, accurate information on implementation accomplishments and problems is a necessary albeit not sufficient element of summative studies that attempt to assess effectiveness of CBI.

III. Evaluation Plan

A. Purpose and Goal

The present evaluation is an examination of networked CAI systems only. The purpose of this evaluation is of a formative nature, with a focus on CAI network systems that have been implemented in Hawaii's public schools during school year 1987-88. The goal is to provide documentation and evidence on what components and services are found to be essential to successful networked systems. There is a critical need, at present, for data on computer-based instruction that will allow school administrators and staff to review existing options, practices and funding. An information base of CAI-related research coupled with profile descriptions of available CAI network systems is a step towards filling the knowledge gap experienced by school administrators faced with decisions on how best to utilize limited resources for computer-based instruction. No attempt will be made here to assess the long-range impact of CAI networks on student achievement, although some preliminary planning by districts for such an anticipated need is suggested.

The intent of the present study is to review and document existing CAI network systems in Hawaii public schools with regard to courseware, hardware, installation, operation, costs, and user perceptions.

The evaluation questions posed were:

(1) For whom and how well were CAI network systems implemented during the field-test SY 1987-88?

(2) What accomplishments were made and what problems were encountered during the start-up year?

(3) What do the various CAI network systems look like; how much do they cost, and how are they similar and different in content and delivery?

(4) What ingredients appear to be crucial to establishing and operating a "successful" CAI network learning environment?

(5) What general observations may be made and what improvements may be suggested after the conclusion of the first-year of implementation?

(6) How extensive are planning and evaluation preparations at school sites? Are necessary steps for further evaluation of CAI network system effectiveness in place?

B. Design

The evaluation is designed to: (1) document results of a limited state-wide field test of CAI network systems; (2) provide profile descriptions of CAI network systems in operation at Hawaii public school sites; (3) identify evaluation potential for further assessment of networked CAI effectiveness; (4) examine similarities and differences among existing CAI network systems, and (5) assist in determining what characteristics or components are essential to a "successful" CAI network system. "Success" here may be defined with respect to usefulness and quality of the system as perceived by end-users, specifically teachers.

The design consisted of site visitations, interviews, and two survey questionnaires, one pertaining to implementation and the other to end-user perceptions. An attempt was also made to establish baseline information with regard to implementation levels and effectiveness ratings. Information derived through the evaluation should be of particular value to state, district, and school decision-makers who are responsible for directing the future of computer-based education in Hawaii. Each individual CAI network is analyzed in terms of its merits and shortcomings, for its purpose and scope, and for its quality in content and delivery.

As an important aside, several items in the Implementation Survey address the "evaluability" of existing CAI network systems. There is a need to first determine what key information is or is not presently available. Since a more in-depth evaluation may ultimately be desirable, proper planning and coordination would be critical to a successful evaluation. Responses to these items will provide the basic groundwork from which such an evaluation could be designed.

C. Method

Participants

Respondents to the survey questionnaires consisted of principals, teachers and lab assistants/coordinators. Of the 19 networked CAI school sites included in the present study, 18 participated in a comprehensive implementation survey. A total of 177 teachers whose students utilized

the CAI network systems responded to items on a user (teacher) survey. School sites from all seven of Hawaii public school districts, including elementary and secondary levels, are represented.

Instrumentation and materials

Two separate surveys have been developed for the expressed purpose of evaluating the CAI networks. The first is an Implementation Survey that contained items in the following areas:

- o hardware requirements
- o courseware content and characteristics
- o computer-managed instruction (CMI) features
- o operations
- o end-user information
- o costs
- o training
- o planning and evaluation

The second instrument is a short, 26-item User survey: Teacher that assessed perceptions of quality, ease of use, and effectiveness. Intended respondents were teachers who utilized the CAI network system by referring their students to scheduled weekly CAI sessions.

Supplemental materials included user manuals, informational brochures, and published research and review articles.

Procedures

Evaluation plans were first developed to determine scope and sequence of the CAI network system review. Initial feedback was solicited from district and state computer education coordinators with respect to evaluation focus, target groups and design. Two survey instruments, Implementation Survey and User Survey: Teacher, were subsequently developed and then reviewed by district and state specialists responsible for computer education in Hawaii. Several items in the draft surveys were then revised prior to actual administration.

Surveys were administered in the second semester of SY 1987-88. All 19 networked CAI school sites were asked to participate in the Implementation Survey. The User Survey: Teacher was also distributed to all teachers at the same sites, except for three intermediate schools. Three Honolulu district intermediate schools had acquired the Computer Curriculum Corporation (CCC) CAI network in early January. Teachers at these CCC sites did not have an opportunity to sufficiently observe students utilizing the newly installed CAI network system. Information was available, however, on installation and operational aspects of CCC.

On-site visits were conducted at 12 of the 19 networked CAI schools. It was not economically feasible to observe CAI sessions at all school sites. Where site visits were made, the evaluator observed lab operations and interviewed available staff which included principals,

teachers, students, lab attendants/coordinators and district specialists who served as computer education coordinators. Data were also obtained via telephone interviews with staff located on neighbor islands.

Data from federally funded programs utilizing CAI network systems (e.g., Chapter 1, Education Consolidation and Improvement Act) were not readily available. Consequently, results of the current study may not be wholly applicable to programs that may be implementing networked CAI with diverse target populations, with different objectives, and under different circumstances.

Data analyses were conducted via statistical and database microcomputer programs. Statistical procedures consisted primarily of univariate statistics such as frequency counts, cross tabulations, ranges and mean averages. Characteristics that were found to be of key interest or importance were aggregated to create profile descriptions of each CAI network system.

IV. Findings and Recommendations

A. Implementation

A review of statewide computer facilities available in Hawaii public schools conducted in spring 1988 produced an initial list of seven different types of CAI network laboratories. One of the initial seven types of CAI network labs identified in spring 1988 (i.e., Ideal Learning) was not fully installed during SY 1987-88. As a consequence, there were a total of six different types of CAI network laboratories included in the present evaluation study.

Also, attempts were being made, at the time, to establish other networked laboratories at a number of sites. These sites included Waipahu High and Castle High. Waipahu High School had been selected as a model site to demonstrate the capabilities of the new Tandy laboratory capabilities at no cost to the DOE. The laboratory was not fully installed as of second semester, SY 1987-88. Castle High School has two labs, one of which is a community-DOE partnership effort whose goal is to serve as a model computer laboratory, housing Apple MacIntoshes for language arts purposes. The proposed MacIntosh lab at Castle was not slated as a CAI networked lab, per se, is dependent upon voluntary community funding, and has not as yet been sufficiently funded.

Structure and Operations

Organizationally, the establishment of pilot CAI network lab efforts was headed by the state educational specialist for computer education, in conjunction with the administrative staff of the Office of Instructional Services. Each district, in turn, had a counterpart who worked cooperatively with CAI vendors to procure, install, operate and maintain network labs. These district educational specialists responsible for

computer education assisted each networked lab school site in start-up activities and implementation strategies. Typically, however, administrators at each school site made day-to-day operational decisions independently of one another.

Operationally, most schools opted for an emphasis on math and reading CAI lessons, but a few expanded on other curriculum areas (e.g., business) or application programs such as wordprocessing and database management systems.

The following is a list of the SY 1987-88 CAI network systems, by CAI proprietorship.

CAI NETWORK SYSTEMS

	SCHOOL	CAI PROPRIETORSHIP
1.	Jarrett Intermediate	Computer Curriculum Corp. (CCC)
2.	Stevenson Intermediate	CCC
3.	Washington Intermediate	CCC
4.	Ahuimanu Elementary	Educational Systems Corp. (ESC)
5.	Kahaluu Elementary	ESC
6.	Kalaheo Elementary	ESC
7.	Nanakuli Elementary	ESC
8.	Laupahoehoe High and Elementary	International Business Machines (IBM)
9.	Mililani High	IBM
10.	Farrington High	PLATO
11.	Aiea High	Prescription Learning Corp. (PLC)
12.	Castle High	PLC
13.	Enchanted Lake Elementary	PLC
14.	King Kamehameha III Elementary	PLC
15.	Lihikai Elementary	PLC
16.	McKinley High	PLC
17.	Pukalani Elementary	PLC
18.	Kalakaua Intermediate	Tandy
19.	Lanai High and Elementary	Tandy

A grand total of 19 CAI networked labs were identified in the present study. These CAI networked systems were primarily supported through state funds. On the other hand, data from other CAI network system laboratories, specifically those funded through ECIA Chapter 1, were not available from some of the seven districts. The target population of students utilizing CAI programs included students in regular as well as special programs. These included both boys and girls at various grade levels (kindergarten to grade 12). In

addition to variability in subject areas covered, CAI lessons were often used for normal developmental and enrichment as well as remediation purposes.

Table 1 serves as a summary chart of the six types of CAI network labs implemented within Hawaii's public schools, by district, grade level and approximate start-up date.

Results of the Implementation Survey

Eighteen of the 19 schools contacted for participation in the Implementation Survey returned the survey instrument (95% return rate) which contained items on hardware, software, operations, costs, training, and planning and evaluation activities (a sample copy is included in Appendix A). Responses from the nineteenth school site, Mililani High School, were not submitted. Follow-up reminders were not successful in obtaining survey responses for both the Implementation Survey and the User Survey: Teacher instruments. Nevertheless, an informal site visitation at Mililani High School was conducted in December 1987.

Hardware

Table 2 provides an overview of selected hardware characteristics for each of the CAI network systems, by CAI proprietorship. All systems were equipped with a single file server. The CCC network system was the only system that linked workstations across schools as well as across workstations within a school. The size of the CAI network systems, essentially defined as the number of operating workstations, ranged from 9 (Kalakaua Intermediate) to 32 (Nanakuli Elementary and Lanai High and Elementary). Typical sizes were in the 15-30 workstation range. Each system had at least one dot matrix printer for hardcopy output. The number and types of peripheral devices available varied with each network system. The ESC program was the only system equipped with a CD-ROM (compact disk).

Software

Information on courseware (instructional software) is summarized in Table 3. All 18 school sites focus on "basic skills." Five sites (28%) also identified "regular curriculum" as an additional focus area. With respect to the purpose of CAI networks, 83% (n=15) of the schools indicated "remediation," 67% (n=12) indicated "normal developmental," and 39% (n=7) indicated "enrichment" (duplicated counts). The most common formats through which CAI were presented were "drill and practice" (100%) and "tutorial" (100%). "Simulation" (33%; n=6) and "educational games" (22%; n=4) were also listed occasionally. Additional questions were asked of the Computer-Managed Instruction (CMI) features. Most of the school sites

Table 1. Six Types of CAI Network Systems Implemented in Hawaii Public Schools, by District, Grade Level, and Start-Up Date (SY 1987-88)

DISTRICT	CAI TYPE	SCHOOL SITE	GRADE LEVELS[1]	START-UP DATE
HONOLULU	CCC	Jarrett Intermediate	7-8	Jan 1988
		Stevenson Intermediate	7-8	Jan 1988
		Washington Intermediate[2]	7-8	Jan 1988
	PLATO	Farrington High	10-12	Aug 1987
	PLC	McKinley High	9-12	Sep 1987
	TANDY	Kalakaua Intermediate	7-9	Nov 1987
CENTRAL	IBM	Mililani High	9-12	Sep 1987
	PLC	Aiea High	9-12	Sep 1987
LEEWARD	ESC	Nanakuli Elementary	K-6	Apr 1987
WINDWARD	ESC	Ahuimanu Elementary	K-6	Aug 1987
		Kahaluu Elementary	K-6	Aug 1987
	PLC	Castle High	9-12	Sep 1987
		Enchanted Lake Elementary	K-6	Sep 1987
HAWAII	IBM	Laupahoehoe High and Elem	K-12	Jan 1988
MAUI	PLC	King Kamehameha III Elem	K-5	Summer 1987
		Lihikai Elementary	K-8	Summer 1987
		Pukulani Elementary	K-6	Summer 1987
	TANDY	Lanai High and Elementary	K-12	Sep 1987
KAUAI	ESC	Kalaheo Elementary	K-6	Sep 1987

[1]Grade level span available; CAI not necessarily implemented all grades.

[2]Serves as host school for CCC network involving three schools.

Table 2. Hardware Characteristics of CAI Network Systems Implemented in Hawaii Public Schools, SY 1987-88

Obs. No.	CAI Proprietorship	School	Dist	File Server Brand	File Server Storage Capacity	Workstation Brand	Workstation No.	Workstation Monitor	Workstation Graphics	Printer Brand	Printer No.	Peripheral Devices CD-ROM	Peripheral Devices Mouse	Peripheral Devices Earphone
1	CCC	Jarrett Inter	HON			Atari	8	Color	Yes	C.ITOH	1	No	Yes	No
2	CCC	Stevenson Inter	HON			Atari	8	Color	Yes	C.ITOH	1	No	Yes	No
3	CCC	Washington Inter	HON	Microhost	>40 MB	Atari	16	Color	Yes	C.ITOH	1	No	Yes	No
4	ESC	Ahuimanu Elem	WIN	Tandy	11-20 MB	Tandy	15	Color	Yes	Tandy	1	Yes	Yes	Yes
5	ESC	Kahaluu Elem	WIN	Tandy	11-20 MB	Tandy	15	Color	Yes	Tandy	1	Yes	Yes	Yes
6	ESC	Kalaheo Elem	KAU	Tandy	11-20 MB	Tandy	30	Color	Yes	Tandy	1	Yes	Yes	Yes
7	ESC	Nanakuli Elem	LEE	Tandy	11-20 MB	Tandy	32	Color	Yes	Tandy	1	Yes	Yes	Yes
8	IBM	Laupahoehoe H & E	HAW	IBM	>40 MB	IBM	20	Color	Yes	IBM	1	No	No	No
9	IBM	Mililani High[1]	CEN	IBM	>40 MB	IBM	25	---	---	---	5	No	No	No
10	PLATO	Farrington High	HON	CDC	>40 MB	CDC	15	Mono	Yes	Epson	1	No	No	No
11	PLC	Aiea High	CEN	IBM	11-20 MB	Apple	12	Color	Yes	Apple	3	No	No	No
							7	Mono	Yes					
12	PLC	Castle High	WIN	IBM	11-20 MB	Apple	12	Color	Yes	Apple	2	No	No	No
13	PLC	Enchanted Lake El	WIN	IBM	11-20 MB	Apple	12	Color	Yes	Apple/IBM	4	No	Yes	Yes[2]
							7	Mono	Yes					
14	PLC	King Kam III El	MAU	IBM	11-20 MB	Apple	19	Color	Yes	Apple	1	No	No	Yes[2]
							11	Mono	Yes					
15	PLC	Lihikai Elem	MAU	IBM	11-20 MB	Apple	18	Color	Yes	Apple/Star	3	No	No	Yes[2]
							11	Mono	Yes					
16	PLC	McKinley High	HON	IBM	11-20 MB	Apple	18	Color	Yes	Apple/Star	4	No	No	Yes[2]
							11	Mono	Yes					
17	PLC	Pukalani Elem	MAU	IBM	11-20 MB	Apple	18	Color	Yes	Apple/Star	4	No	No	Yes[2]
							11	Mono	Yes					
18	Tandy	Lanai High & El	MAU	Tandy	10 MB	Tandy	32	Mono	Yes	Tandy	--	No	No	No
19	Tandy	Kalakaua Inter	HON	Tandy	< 10 MB	Tandy	9	Mono	Yes	Tandy	1	No	No	No

[1]Information based on site observations.

[2]Earphones equipped on a portion of workstations.

Table 3. Courseware (Instructional Software) Characteristics of CAI Network Systems Implemented in Hawaii Public Schools, SY 1987-88

Obs. No.	CAI Proprietorship	School	Dist	FOCUS AREA: Basic Skill	FOCUS AREA: Reg Curr	FOCUS AREA: Special Topic	PURPOSE: Remedial	PURPOSE: Normal Develop	PURPOSE: Enrich	CAI FORMAT: Drill & Practice	CAI FORMAT: Tutor	CAI FORMAT: Simul	CAI FORMAT: Educ Games	STUD TEST A[1]	STUD TEST U[2]	DIAG PLACE A	DIAG PLACE U	PRESCRIP ACTIV A	PRESCRIP ACTIV U	RECORDS MGMT A	RECORDS MGMT U
1	CCC	Jarrett Inter	HON	Yes	No	No	Yes	No	No	Yes	Yes	Yes	No	Y	Y	Y	Y	Y	Y	Y	Y
2	CCC	Stevenson Inter	HON	Yes	No	No	Yes	No	No	Yes	Yes	No	No	Y	Y	Y	Y	Y	Y	Y	Y
3	CCC	Washington Inter	HON	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	N	N	Y	Y	Y	Y	Y	Y
4	ESC	Ahuimanu Elem	WIN	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Y	Y	Y	Y	Y	Y	Y	Y
5	ESC	Kahaluu Elem	WIN	Yes	Yes	No	No	Yes	No	Yes	Yes	No	No	Y	Y	Y	Y	Y	Y	Y	Y
6	ESC	Kalaheo Elem	KAU	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	No	Y	Y	Y	Y	Y	Y	Y	Y
7	ESC	Nanakuli Elem	LEE	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	No	Y	Y	Y	Y	Y	Y	Y	Y
8	IBM	Laupahoehoe	HAW	Yes	No	No	Yes	No	No	Yes	Yes	Yes	Yes	Y	Y	Y	Y	Y	Y	Y	Y
9	PLATO	Farrington High	HON	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	No	Y	Y	Y	Y	Y	Y	Y	Y
10	PLC	Aiea High	CEN	Yes	No	No	Yes	No	No	Yes	Yes	No	No	Y	Y	Y	Y	Y	Y	Y	Y
11	PLC	Castle High	WIN	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	No	Y	Y	Y	Y	Y	Y	Y	Y
12	PLC	Enchanted Lake	WIN	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Y	Y	Y	Y	Y	Y	Y	Y
13	PLC	King Kam III	MAU	Yes	No	No	Yes	Yes	No	Yes	Yes	No	No	Y	Y	Y	Y	Y	Y	Y	Y
14	PLC	Lihikai Elem	MAU	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Y	Y	Y	Y	Y	Y	Y	Y
15	PLC	McKinley High	HON	Yes	No	No	Yes	No	No	Yes	Yes	No	Yes	Y	Y	Y	Y	Y	Y	Y	Y
16	PLC	Pukalani Elem	MAU	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	No	Y	Y	Y	Y	Y	Y	Y	Y
17	Tandy	Lanai High & El	MAU	Yes	No	No	No	Yes	No	Yes	Yes	Yes	No	Y	Y			Y	Y		
18	Tandy	Kalakaua Inter	HON	Yes	No	No	Yes	No	Yes	Yes	Yes	Yes	No	N	N	Y	Y	N	N	Y	N
		Total "Yes"		18	5	1	15	12	7	18	18	6	4	16	16	17	17	17	17	17	16
		% "Yes"		100%	28%	6%	83%	67%	39%	100%	100%	33%	22%	89%	89%	94%	94%	94%	94%	94%	89%

[1]Available: Y = Yes N = No

[2]Utilized: Y = Yes N = No

reported that CMI components such as student testing, diagnostic placement, prescriptive activities and records management were available and were being utilized. The extent and success of such utilization is not readily known, but results from the teacher survey (next section) indicates CMI is often under-utilized.

Operations

Information on operational aspects of each CAI network system is listed in Table 4. None of the schools reported that any significant problems were experienced during installation of the CAI network. Five schools (28%), however, from three different systems indicated that the installation was not promptly completed. Most schools considered vendor support to be adequate; one school was not sure, another indicated support was not adequate and still another replied that vendor support was not available at all. When asked if the network system was reliable, 14 schools (78%) responded with a "yes," two schools (11%) were unsure, one school said "no," and one school left that item blank. The number of system failures experienced during the first three months of operation ranged from none to 24. Understandably, the school (Farrington High) that reported the two dozen failures was the same school that considered its system to be unreliable. It should be mentioned here that most of the failures were either hardware or software related, but the incidence of failures reported also included occasional electrical outages.

All but one of the network systems surveyed had workstation hardware that could be independent and adaptable to other application programs. The PLATO system at Farrington High School utilized Control Data Corporation (CDC) workstations that were dedicated solely to the CAI network. These CDC workstations could not perform wordprocessing or database management programs independently of the fileserver and network components.

The typical number of students per workstation in a CAI session was one, except for two schools that reported two students sharing single workstations. The scheduling of CAI sessions was quite varied. One school scheduled students for ten minutes a day, five times a week, while another scheduled its students for more than 30 minutes, once a week. The rationale for having such diverse scheduling patterns should be further explored, in light of recommendations that have stemmed from research on the relative efficiency of schedule patterns.

Further data on operational activities of CAI network systems include source of CAI network coordination, source of

Table 4. Operational Characteristics of CAI Network Systems Implemented in Hawaii Public Schools, SY 1987-88

Obs. No.	CAI Prop.[1]	School	Installation: Signif. Problem	Installation: Promptly Complted.	Vendor Support: Adequate	System Reliable	No. System Failures First 3 Mos.	HW Prob.[2]	SW Prob.[2]	Hardware Adaptable To Other Programs	No. Students Per Work-Station	Physical Setting	Session Length	No. Sessions Per Week	Exposure Per Week	Who Coordinates	Who Selected	Mean No. Teachers Who Refer (Weekly)	Mean No. Students Who Use (Weekly)	Mean No. Referrals
1	CCC	Jarrett	No	No	Yes	Yes	1	No	No	Yes	2	Lab	21-25 min	2	50 min	Teacher	Dist Admin	7	95	14
2	CCC	Stevenson	No	Yes	Yes	Yes	6	No	Yes	Yes	1	Mult rms	1-15 min	4	60 min	Lab attndt	Dist Admin	4	84	21
3	CCC	Washington	No	Yes	Yes	Yes	6	No	No	Yes	1	Lab	1-10 min	5	50 min	Lab attndt	Dist Admin	12	180	15
4	ESC	Ahuimanu	No	Yes	Yes	Yes	3	No	Yes	Yes	1	Lab	16-20 min	2	40 min	Lab attndt	Dist Admin	24	608	25
5	ESC	Kahalua	No	Yes	Yes	Yes	0	No	No	Yes	1	Lab	> 30 min	2	> 60 min	Lab attndt	Mult sources	13	245	19
6	ESC	Kalaheo	No	Yes	Yes	Yes	0	No	No	Yes	1	Lab	21-25 min	3	75 min	Lab attndt	Mult sources	22	550	25
7	ESC	Waiakuli	No	Yes	Unsure	Yes	3	No	Yes	Yes	1	Lab	26-30 min	2	60 min	Lab attndt	Dist Admin	20	440	22
8	IBM	Leapehoehoe	No	Yes	Yes	Unsure	1	No	Unsure	Yes	1	Mult rms	> 30 min	5	>150 min	Teacher	Sch Admin	8	20	2.5
9	PLATO	Farrington	No	Yes	Yes	No	24	Yes	No	No	1	Lab	> 30 min	1	> 30 min	Teacher	Dist Admin	10	400	40
10	PLC	Aiea	No	Yes	Yes	Yes	0	No	No	Yes	1	Lab	> 30 min	1	> 30 min	No coord	Mult sources	6	350	58
11	PLC	Castle	No	No	Yes	Yes	1	No	Yes	Yes	1	Lab	> 30 min	2	> 60 min	Teacher	Dist Admin	18	320	18
12	PLC	Enchanted Lk	No	No	Yes	Yes	4	No	No	Yes	1	Lab	> 30 min	2	> 60 min	Teacher	Mult sources	10	250	25
13	PLC	King Kam III	No	Yes	Yes	---	1	No	No	Yes	1	Lab	> 30 min	5	>150 min	Teacher	Mult sources	7	195	28
14	PLC	Lihikai	No	No	Yes	Unsure	1	No	No	Yes	1	Lab	> 30 min	-	---	Teacher	Dist Admin	27	427	16
15	PLC	McKinley	No	Yes	Yes	Yes	0	No	No	Yes	1	Lab	> 30 min	2	> 60 min	Teacher	Dist Admin	5	347	69
16	PLC	Pukalani	No	Yes	Yes	Yes	0	No	Unsure	Yes	1	Lab	> 30 min	5	>150 min	Teacher	Dist Admin	7	74	11
17	Tandy	Lanai	No	No	No	Yes	2	No	Yes	Yes	1	Lab	26-30 min	5	150 min	Teacher	(donated)	--	---	--
18	Tandy	Kalakaua	No	Yes	N/A	Yes	1	Yes	Yes	Yes	2	Mult rms	16-20 min	2	40 min	Lab attndt	Dist Admin	5	200	40
		Total "Yes"	0	13	15	14	-	2	6	17										
		% "Yes"	0%	72%	83%	78%	-	11%	33%	94%										

[1] Proprietorship

[2] Problems

CAI network selection, and information on referrals to the CAI network system.

Costs

Comparative costs and selected data on contractual arrangements for the 18 CAI network systems are summarized in Table 5. Cost estimates were difficult to determine due to differences in type and length of contractual agreements. The specificity of contractual agreements also varied widely among the network systems. Differences were also found in contract content within a network system that operated at multiple school sites (e.g., PLC).

Cost estimates were calculated using a somewhat arbitrary base of five years for all network systems. As much as was possible, all non-recurring and recurring costs were included in computations, except where noted. Total costs (over five years) ranged from a low of $3,400 for a 32-workstation Tandy system at Lanai High and Elementary, to a high of $290,000 for a 32-workstation ESC system at Nanakuli Elementary. Much of Lanai's network system was donated by Tandy Corporation, whereas the ESC system at Nanakuli included state-of-the-art components, courseware updating, and provisions for a lab attendant. The mean (average) total cost for all systems was slightly more than $124,200.

Cost per workstation over the same five-year interval ranged from a low of $106 (Tandy-Lanai) to a high of $9,792 for each of the two identical 15-workstation ESC systems at Ahuimanu and Kahaluu. The mean (average) cost per workstation was approximately $5,600.

Estimates of average annual costs ranged from $680 (Tandy-Lanai) to $58,000 (ESC-Nanakuli). More typical annual costs were in the $20-$30 thousand range; mean (average) annual cost was slightly above $26,000. The most important figures, perhaps, are the average annual cost per workstation. These estimates ranged from a low of $21 (Tandy-Lanai) to $1,958 (ESC-Ahuimanu, Kahaluu) per workstation, per year. The mean (average) annual cost per workstation was approximately $1,150.

Again, these cost figures are based on extrapolations over a five-year span under various contractual arrangements. Five of the network systems include lab attendants in the cost calculations. In reality, assumptions such as lab attendant availability over five years are quite tenuous. A number of other schools hired a lab attendant or teacher-coordinator through additional funds and are not reflected here (e.g., Washington Intermediate). Moreover, there are significant differences over the eventual entitlement of hardware and

Table 5. Comparative costs and Contractual Arrangements for CAI Network Systems at 18 Hawaii Public School Sites, SY 1987-88

School Site	CAI Network System	Total Cost (Base = 5 Yrs)	No. Workstations	Cost Per Workstation	Avg. Annual Cost	Avg. Annual Cost Per Workstation	Lab Attendant Included?	Purchase/Lease	
								Hardware	Software
1. Washington Int.	CCC	$ 162,595	32	$ 5081	$ 51,933	$ 1623	No	Purchase	Purchase
2. Jarrett Int.									
3. Stevenson Int.									
4. Ahuimanu El.	ESC	146,885	15	9792	29,377	1958	Yes	Lease[1]	Lease
5. Kahaluu El.	ESC	146,885	15	9792	29,377	1958	Yes	Lease[1]	Lease
6. Kalaheo El.	ESC	266,837	30	8895	53,367	1779	Yes	Lease[1]	Lease
7. Nanakuli El.	ESC	290,000	32	9063	58,000	1813	Yes	Lease[1]	Lease
8. Laupahoehoe High & El.	IBM	60,996[2]	20	3050	12,199	610	No	Purchase	Purchase
9. Farrington High	PLATO	123,835	15	8256	24,767	1651	No	Purchase	Purchase
10. Aiea High	PLC	125,000	9	6579	25,000	1316	No	Lease	Lease
11. Castle High	PLC	105,000	19	5526	21,000	1105	No	Lease[3]	Lease
12. Enchanted Lake	PLC	105,000	19	5526	21,000	1105	No	Lease[3]	Lease
13. King Kam III El.	PLC	100,000	29	3448	20,000	690	No	(unclear)	(unclear)
14. Lihikai El.	PLC	100,000	29	3448	20,000	690	No	(unclear)	(unclear)
15. McKinley High	PLC	125,000	29	4310	25,000	862	Yes	(unclear)	Lease
16. Pukalani El.	PLC	100,000	29	3448	20,000	690	No	(unclear)	(unclear)
17. Lanai High & El.	TANDY	3,400[4]	32	106	680	21	No	N/A	N/A
18. Kalakaua Int.	TANDY	26,390	9	2932	5,278	586	No	Purchase	Purchase

[1]May be purchased for fee of $1.00 after fourth year.

[2]Conservative estimate; does not include recurring costs such as repair, maintenance and software updates.

[3]Lease with buy out options available.

[4]Substantial amount of CAI network lab was donated by Tandy Corporation.

software ownership. Distinctions between purchase and lease agreements are blurred by additional options to "buy out" for nominal fees after expiration of agreements (e.g., ESC).

The most disconcerting finding with respect to contractual agreements is vagueness in contracts with PLC. District administration staff report they are unclear as to the eventual ownership of hardware, software, documentation, etc. Further, the "School Within a School" concept associated with the PLC agreement was an integral part of the contract agreement. District personnel were left with the understanding that should the School Within a School program (a for-profit venture managed by PLC staff, on school grounds, utilizing the same network system during non-school hours) turn a profit during the first year, the entire cost for the network system would be waived. At it turned out, PLC was unable to initiate its program promptly during the school year, and consequently profits were not realized. It is unclear whether this cooperative agreement of waiving costs contingent on profit was instituted with all PLC school sites. To its credit, PLC did reduce the second year costs by $10,000 in at least one district (Maui) as compensation. According to the PLC representative, other PLC sites received a $5,000 reduction for year 2. Unfortunately, the bottom line is that there simply are too many questions left unanswered for district support staff with respect to contract arrangements. Will the school ever own the hardware? The software? Will there be options for buy-out? Why are the Pioneer video-laser disc players not utilized in any of the PLC labs visited?

Training

Information on in-service training received in SY 1987-88 and further needs for training is included in Table 6. Though all of the schools reported that teacher in-service training was conducted, there were vast differences in the numbers trained, the source of training and the extent of training received. Seventy-two percent of the schools (n=13) stated they either needed or were unsure if they needed further training. Examples of training needs ranged from basic understanding of the CAI network capabilities, to trouble-shooting, to assistance in integrating the courseware with classroom activities.

Planning and Evaluation

Finally, information on preparatory steps essential to subsequent evaluation efforts was obtained for each school site. Table 7 provides a summary of responses for each CAI network system and school site. A cautionary note may be in order here. Although many of the responses to the direct inquiries into planning and evaluation were in the affirmative, the response patterns were often indicative of inconsistencies or

Table 6. Training Aspects of CAI Network Systems Implemented in Hawaii Public Schools, SY 1987-88

Obs. No.	CAI Proprietorship	School	Dist	Teacher In-Svcs Training	No. Teachers Trained	Source of Training	Hours of Training Received	More Training Needed	Training Needs
1	CCC	Jarrett Inter	HON	Yes	1	Contractor	20	No	
2	CCC	Stevenson Inter	HON	Yes	1	Vendor	1	Yes	In-service classroom teachers, CCC program and reports
3	CCC	Washington Inter	HON	Yes	45	Vendor / School Staff	33	No	
4	ESC	Ahuimanu Elem	WIN	Yes	31	Contractor	8	Yes	In-service new teachers, specific topics
5	ESC	Kahaluu Elem	WIN	Yes	25	Contractor	8	Yes	Troubleshooting, CMI
6	ESC	Kalaheo Elem	KAU	Yes	30	Vendor	1	No	
7	ESC	Nanakuli Elem	LEE	Yes	23	Vendor	1	Unsure	
8	IBM	Laupahoehoe H & E	HAW	Yes	2	Vendor	50	Yes	Intro to new software
9	PLATO	Farrington High	HON	Yes	20	Vendor	18	No	
10	PLC	Aiea High	CEN	Yes	4	Vendor	16	Unsure	
11	PLC	Castle High	WIN	Yes	9	Vendor	14	Yes	Network, software, integration
12	PLC	Enchanted Lake El	WIN	Yes	10	Vendor / District Staff	14	Yes	Initial training, K-2 Follow-up training, 3-6
13	PLC	King Kam III El	MAU	Yes	34	Contractor	50	Yes	CAI network
14	PLC	Lihikai Elem	MAU	Yes	42	Vendor	5	Yes	Computer literacy, Word processing
15	PLC	McKinley High	HON	Yes	8	Vendor	24	No	
16	PLC	Pukalani Elem	MAU	Yes	1	Vendor	15	Unsure	
17	Tandy	Lanai High & El	MAU	Yes	32	Vendor / District Staff	2	Yes	Classroom applications, more difficult programs, specific guidelines of CAI
18	Tandy	Kalakaua Inter	HON	Yes	20	School Staff	1.5	Yes	Classroom utilization and integration

Table 7. Planning and Evaluation Aspects of CAI Network Systems Implemented in Hawaii Public Schools, SY 1987-88

Obs. No.	CAI Proprietorship	School	Dist	Outcome Objectives Identified?	Outcome Measures Identified?	Examples, Outcome Measures	Focus / Target Population	Data Collection Procedures Established?
1	CCC	Jarrett Inter	HON	Yes	Yes	CCC tests, SDMT, ITBS	Basic skills, English, Math	Yes
2	CCC	Stevenson Inter	HON	Yes	Yes	SAT	PINS classes	Yes
3	CCC	Washington Inter	HON	Yes	Yes	SAT	Low achievers, alienated	Yes
4	ESC	Ahuimanu Elem	WIN	Yes	Yes	---	Regular education	Yes[1]
5	ESC	Kahaluu Elem	WIN	Yes	Yes	SAT	All students	Yes[1]
6	ESC	Kalaheo Elem	KAU	Yes	Yes	SAT	All students	Yes[1]
7	ESC	Nanakuli Elem	LEE	Yes	Yes	SAT, surveys	All students	Unsure
8	IBM	Laupahoehoe	HAW	Unsure	Yes	SAT, HSTEC	Remedial	Yes
9	PLATO	Farrington High	HON	Yes	Unsure	HSTEC	Low reading, math	Unsure
10	PLC	Aiea High	CEN	No	---	---	Math	---
11	PLC	Castle High	WIN	Yes	Yes	Nelson (reading) Brigance (math)	High incidence classes, stanines 1-3	Yes
12	PLC	Enchanted Lake El	WIN	Unsure	Unsure	---	---	Unsure
13	PLC	King Kam III El	MAU	Yes	---	---	Remedial, K-5	Yes
14	PLC	Lihikai Elem	MAU	Yes	Yes	SAT	Basic skills, K-6	Yes
15	PLC	McKinley High	HON	Yes	Yes	---	Cross-section of all students	Yes
16	PLC	Pukalani Elem	MAU	Unsure	Unsure	---	All students	Unsure
17	Tandy	Lanai High & El	MAU	Yes	No	---	All students, K-12	No
18	Tandy	Kalakaua Inter	HON	Yes	No	---	Basic skills, 7-8	Yes

[1]Data collection assumed to be responsibility of vendor.

uncertainty. Data were often missing for crucial items on evaluability such as "Have outcome measures been identified?" and "If 'yes,'....please list." One is left with the impression that preparatory steps for further evaluation is less than adequate for most of the school sites.

Further, there are quite remarkable differences among schools and CAI network systems in descriptions of specificity. For example, some schools include objectives that are characterized by broad, general statements of outcome. Other schools are much more specific and definitive, and include information on criteria and focal areas. Follow-up interviews and discussions via site visitations further attest to the need for evaluation services, from the onset of implementation. School principals, teachers and lab staff ask for assistance in the designing, executing and analyzing phases of program evaluation. What seems most needed is technical assistance support on an ongoing basis. The most transparently efficient support system is a decentralized one. Schools seem to require district level assistance in these regards, at the very least.

A significant, general need, in terms of planning and evaluation of CAI network systems, is program-wide planning for assessment of CAI impact. Without systematic, designed evaluations with some control over the numerous variables that influence student outcome and simultaneously interact with one another, it is virtually impossible to deduce which sources contributed to what extent in improving student performance. Research and evaluation in this area is indeed difficult as one may surmise after reviewing the vast literature on CAI effectiveness over the last decade. But it is as equally important to continue the attempt to identify what works and what doesn't for whom and under what conditions.

Annotated Summary of Interviews and On-Site Observations

Interviews

The following brief notes on implementation issues serve to highlight several concerns voiced by district and school officials.

Selection: Districts felt rushed in selecting, purchasing, and installing CAI networks. More time is needed to research background info; assistance needed in weighing pros and cons. Questions asked: "For whom is the system best suited?" "Are the lessons based on sequentially developed curricula?" "How do the lessons coincide with Hawaii's performance expectations or the foundation program as a whole?" "What are the

strengths and weaknesses of the various network systems?"

Procurement: Administrative obstacles were sometimes encountered in procuring certain items necessary to operate the network system. Given the underlying rationale for field-testing a variety of network systems, several interviewees expressed a concern over conflicts between regulatory procedures (e.g., bid process) and the intent of the field-test. Clearances or exceptions to policy may alleviate certain barriers.

Management & Operations: Teachers, schools need assistance in managing networked CAI classes. Help needed in learning how best to arrange, distribute CAI sessions for different subject areas, different student types.

On-Site Observations

CCC: Washington Int. Serves as host school to two other intermediate schools all linked to a single file server. Emphasis on distributed learning approach reflected by Washington's 10 minute sessions, 5x week, (shortest span of all systems evaluated). CMI-functions include reports either on individual students or entire class, with additional feature of generating supplemental homework items if desired. Lab attendant position filled via educational aide slot.

ESC: Ahuimanu El. 1/2 class used ESC, each to a workstation, while other half used Apple stand alones, 2-3 to a station (advantage: teacher accompanies class and gains insights to attempts in integrating courseware with class activities, curriculum). Lab attendant appears to be valuable resource for sucessful operations.

Kahaluu El. 1/2 class use ESC, each to a workstation, while other half remains in classroom with teacher. (Note. Principal reported that attempts to divide classrooms into half ESC, half Apple lab resulted in distraction and logistic problems so approach was abandoned). Lab attendant appears to be valuable resource for successful operation.

Kalaheo El. Entire class, accompanied by teacher, use lab facilities. Three part-time lab attendants pivotal in successful operation. These lab attendants

happen to also be parents active in school extra-curricular functions.

Nanakuli El. Entire class uses lab, one of two largest labs equipped with 32 workstations; was first of ESC labs in Hawaii, originally installed in March 1987 w/ tape drive later switched to CD-ROM. Teacher occassionally asks attendant to emphasize particular areas in math/reading. CMI reports on individual students provided to teacher. All grades targeted, even preschool children are obtaining some hands-on experience. (Note. Temperature in narrow lab room noticeably high; ventilation is limited; recommend room be adequately air conditioned).

IBM: Laupahoehoe High & El. Hardware includes PS/2 line for both workstation (20) and file server (1). Power and speed would seem adequate, but standard input/output equip. only, no additional peripheral devices. Lab is actually divided into separate rooms; bulk of equipment in one room shared with other Apple computers (stand alone); couple in another room for more one-to-one attention for selected students. District voiced concern over limitations in software scope and sequence, and desire to utilize other general application programs as well.

Mililani High. Lab situated in business/computer science department classrooms. CAI not implemented; instead, generic application programs (e.g. wordprocessing, spreadsheet, database) are emphasized primarily for business and computer science classes only. No teacher referral arrangement. Hardware configuration similar to Laupahoehoe with 25 instead of 20 workstations. Same room shared with 14 older Tandy computers that are not networked. Network potential under-utilized during SY 1987-88; CAI software scheduled for installation prior to SY 1988-89.

PLATO: Farrington High. PLATO system adapted to operate on Control Data Corporation hardware. All 15 workstations have monochrome monitors, but graphics and resolution are good. System reported to have CMI capabilities, but presently only class summaries produced for teachers; no individual feedback to identify strengths and weaknesses. System noticeably slow in loading software modules. Several attempts made to increase speed (e.g., motherboard replaced). Slow speed especially problematic with reading programs; students impatient. Due in part to small lab size (15 workstations), teacher not always

accompanying students; no systematic attempt to integrate courseware w/ class instruction. One curriculum guide available; another condensed guide for teacher to use as resource, but not often utilized at present. Math classes typically smaller so usually entire math class accomodated. School wants to use PLATO for students having difficulties with passing the Hawaii State Test of Essential Competencies (HSTEC), but need to first analyze if PLATO appropriate for that purpose, and if so, which modules should be recommended. More teacher in-service training needed. Lab attendant position filled by teacher serving as lab coordinator.

PLC: All PLC labs initiated via "School w/in School" program, where cooperative provisions made for PLC to use facilities during off-hours, for profit, in exchange for relatively low-cost network system.

Aiea High. Class accompanied by teacher when using lab. No lab attendant available. Teachers use written log for problems encountered. PLC support staff periodically troubleshoot problems. Workstations are 19 Apple IIe models, linked to IBM-XT file server. CMI controlled by file server, but loading of courseware done manually by student after selecting appropriate floppy diskette from bookshelves. Not utilizing full advantage of network system with this method. File server could accomplish same with more efficiency and automatically load where same student previously left off. Two Pioneer laser discs not being used.

Castle High. Three part-time lab attendants. Intact classes using lab, but only 19 terminals, so larger classes may need to share terminals or find other solutions. Lab is used M-F, 6 periods a day. Emphasis on reading/math. Hardware configuration similar to Aiea High School (see above). Problem voiced over PLC placement test. Scores must be manually inputted for each individual student. Possible solution may be to use a scanner to load scores into CMI component? Pioneer laser disc equipment (2) not being utilized.

Enchanted Lake Elem. PLC used with grades 3-6 intact classes. Some terminals are shared by student pairs (only 19 stations). Grades K-2 use other lab (not networked) equipped w/ 11 Apple IIe or IIc computers. No lab attendant. Hardware configuration similar to Aiea High School (see above). Teachers trained over summer, but no

hands-on till Fall semester. Emphasis on reading/math. Same problem as Castle w/ regard to placement testing procedures. Need also expressed for teachers to learn how to integrate courseware w/ class instruction.

McKinley High. Only PLC lab with attendant arranged through contract agreement. Similar hardware configuration as Aiea High School except 29 Apple IIes serve as workstations. Class arrangement/coordination characterized by entire class utilizing lab, accompanied by teacher and further assistance provided by lab attendant responsible for routine operations and generation of CMI reports. Curricula focus on reading, language arts and math. Curriculum guide available for teacher use.

B. Perceptions of Effect

Results of the User Survey: Teacher

Demographics

A total of 177 teachers from 18 schools whose students utilized the CAI network systems responded to items on the user (teacher) survey.

All seven of Hawaii's public school districts are represented but the percentages varied greatly. Table 8 provides a summary of the proportion of teachers who participated from each district. The largest numbers of teachers were from Maui (n=65; 37%) and Windward (n=53; 30%) districts. The fewest numbers of teachers who participated were from Hawaii (n=2; 1%) and Central (n=5; 3%).

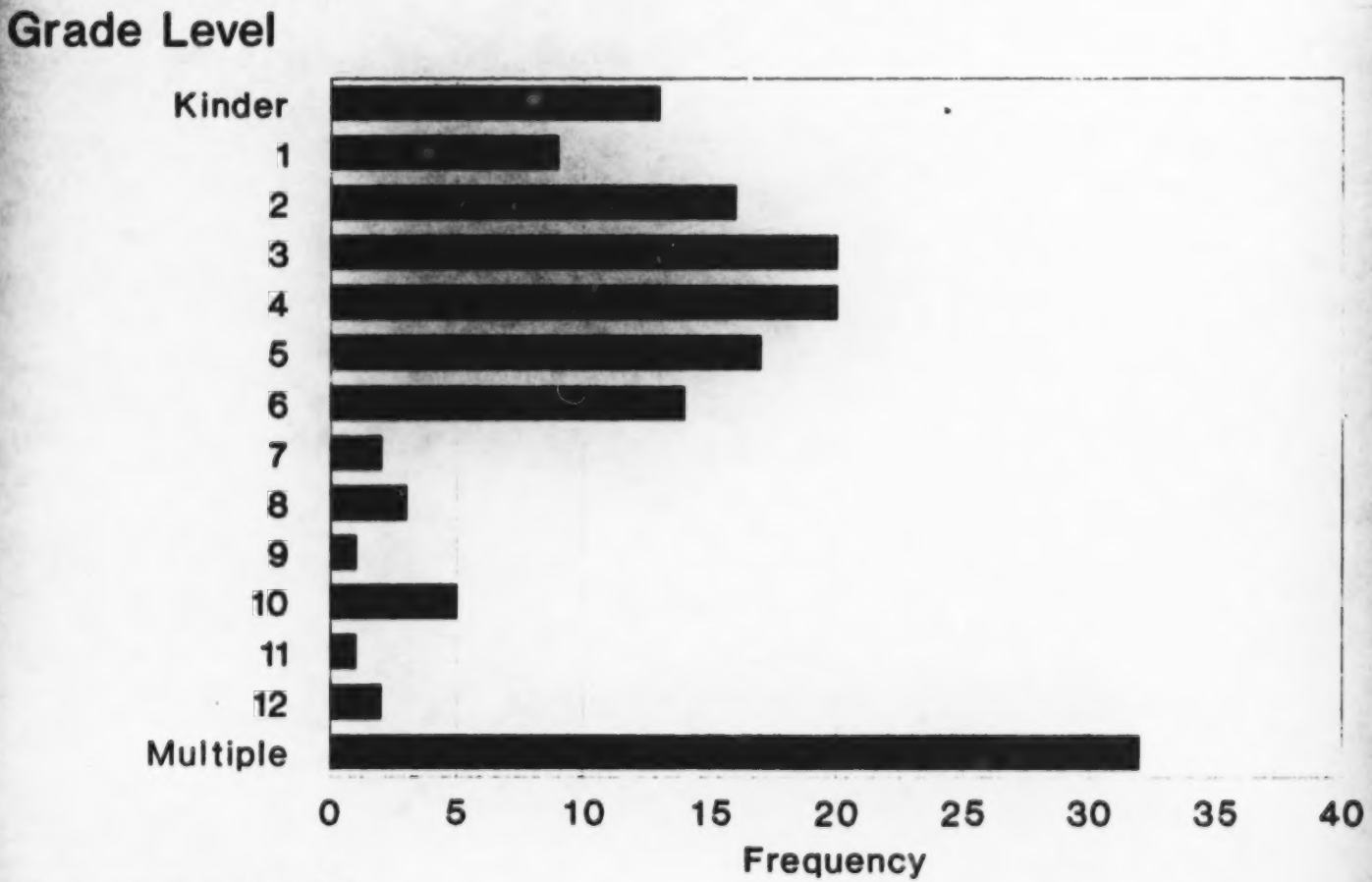
The grade levels at which the teachers were assigned ranged from kindergarten to grade 12. However, the majority of teachers represented the elementary grade levels (n=109; 62%). Figure 1 provides a graphic view of the grade level breakdown. A total of 22 teachers (12%) did not report the grade level(s) at which they taught. Another 32 (18%) reported multiple grade levels that prevented classification into discrete types.

The bulk of the participants were assigned to schools that ulitized the Prescription Learning Corporation (PLC) network system (n=86; 49%). The next largest group of teachers were assigned to schools with the Educational System Corporation (ESC) network system (n=64; 36%). Teachers from the

Table 8. Number and percent of teacher participants, by district

DISTRICT	FREQ	PERCENT	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT
HONOLULU	20	11.3	20	11.3
CENTRAL	5	2.8	25	14.1
LEEWARD	14	7.9	39	22.0
WINDWARD	53	29.9	92	52.0
HAWAII	2	1.1	94	53.1
MAUI	65	36.7	159	89.8
KAUAI	18	10.2	177	100.0

FIGURE 1
Number of teachers by grade level



Number not reported: 22

remaining Tandy, PLATO and IBM network systems collectively represented only 15% of the entire sample (Table 9).

General Findings

Items addressed perceptions and ratings of quality, ease of use, and effectiveness of the CAI network system. A sample of the teacher survey, along with alias names for each variable (e.g., V1 for variable or item no. 1) are included in Appendix B. Responses are based typically on knowledge and assessment of only one CAI network system. Virtually all teachers are NOT, at this time, able to provide ratings on quality of efficiency based on a knowledge of multiple CAI network systems.

Overall Assessment of the CAI Network Systems

(1) Approximately 84% of the teachers believe the CAI network system helps their students learn efficiently (15% undecided).

(2) Eighty-six percent (86%) feel the CAI network system helps students improve their academic skills (14% undecided).

(3) Seventy-two percent (72%) think the CAI network system helps in improving the delivery of instruction (24% undecided, 4% disagree).

(4) Ninety-five percent (95%) agree that the CAI network system provides individual instruction where pace and sequence are controlled by the student (4% undecided).

(5) Eighty-four percent (84%) consider the CAI network system an effective means of instruction (13% undecided, 3% disagree).

(6) Eighty-nine percent (89%) believe student interest in learning is enhanced (8% undecided, 3% disagree).

(7) Eighty-three percent (83%) report that positive student attitudes towards learning is fostered (14% undecided, 3% disagree).

(8) Sixty percent (60%) consider CAI network system is at times better than traditional classroom instruction (26% undecided, 14% disagree).

(9) Overall mean average rating for microcomputer **hardware** used to present the CAI (based on a scale from 1 to 5, 1 = "Very Ineffective" and 5 = "Very Effective"): **3.4**

Table 9. Number and percent of teacher participants, by CAI network system

CAI NETWORK	FREQ	PERCENT	CUMULATIVE FREQ	CUMULATIVE PERCENT
ESC	64	36.2	64	36.2
IBM	2	1.1	66	37.3
PLATO	11	6.2	77	43.5
PLC	86	48.6	163	92.1
TANDY	14	7.9	177	100.0

Assessment of the CAI Courseware:

(1) Eighty-nine percent (89%) feel the CAI network system software programs are appropriate for their students' levels (7% undecided, 5% disagree).

(2) Sixty-five percent (65%) think that accurate diagnoses are provided for placing students at the proper courseware level (30% undecided, 5% disagree).

(3) Eighty-three percent (83%) consider the content accurate (16% undecided, 1% disagree).

(4) Overall mean average rating for CAI **instructional software** (on a scale from 1 to 5, 1 = "Very Ineffective" and 5 = "Very Effective"): **3.4**

Appraisal of Implementation Concerns:

(1) Twenty-three percent (23%) report not feeling comfortable using computers to deliver instruction (19% unsure, 58% consider themselves comfortable).

(2) Ninety-one percent (91%) use CAI network systems only as a supplement to instruction; 9% use either to supplement or replace instruction; less than 1% use strictly as replacement.

(3) Sixty-five percent (65%) indicate they would like assistance in integrating CAI courseware with classroom curricula (22% undecided, 14% do not request such assistance).

(4) Sixty-nine percent (69%) feel that outcome measures (tests, quizzes) used within the CAI network systems are appropriate (26% unsure, 5% do not feel measures are appropriate).

(5) Teachers utilize the instructional software for:

a. Remedial basic skills activities (70%)
b. Normal developmental activities (63%)
c. Enrichment activities (37%)

(6) Seventy-four percent (74%) indicated they need help in utilizing the CAI features such as testing, placing, keeping records and prescribing appropriate instructional strategies.

(7) Mean average rating for **training** received in preparation for CAI network use (based on a scale from 1 to 5, 1 = "Very Ineffective," 5 = "Very Effective"): **2.9**

The analyses of responses from the entire sample of 177 teachers reveal that, in general, CAI network systems started in Hawaii public schools during SY 1987-88 are seen as a viable, effective tool when used as a supplement to traditional instruction. The most salient advantage of the CAI network system is the ability to provide individual, self-paced instruction with a level of novelty that increases student interest and motivation to learn. Of significance is the perception that this method of instructional delivery is, at times, as good as or better than traditional instruction, particularly in light of whose perspective is being analyzed. One might well expect this particular group of individuals to be especially conservative in appraising the educational qualities of CAI, as such alternative instructional methods can and has posed a direct threat to an instructor's sense of security. Interestingly enough, only 26% of the teachers indicated they were unsure that CAI network systems are at times better than traditional classroom instruction; and only 14% responded with direct contradiction.

With regard to instructional software, or courseware, most teachers do not seem to have any qualms about the accuracy of subject content or the appropriateness of the CAI lessons at the grade levels recommended. Over a third, however, are either uncertain or are concerned about possible inaccuracies in placing students at proper courseware levels. This potential problem may stem from several sources, one of which may be a basic mechanical problem with the network system's diagnostic placement procedures. On the other hand, problems may also arise due to poor implementation by lab staff or teacher of the system's placement procedure. It is far too early to tell at this juncture which sources contribute most to such problems.

With respect to implementation concerns, several findings merit discussion. First, a sizeable portion of teachers indicate they either are feeling uncomfortable or are unsure if they are uncomfortable (42%). This would help explain why so few teachers utilize the CAI features regularly, and why so many teachers report they need assistance in utilizing CMI features (74%) or in integrating CAI courseware with instructional curricula (65%).

Second, an overwhelming proportion of teachers use the CAI to supplement classroom instruction (99%). Only one teacher reported using the CAI solely for replacement purposes. Third, teachers most often use the CAI for remediation of basic skills or for normal developmental instructional activities. Still, over a third of the teachers use these CAI lessons for enrichment activities as well.

Finally, although a majority of the teachers indicated that outcome measures such as the (network system's) tests or quizzes seem appropriate, almost a third are either unsure or do not feel such measures are adequate or appropriate. These results are consistent with the responses in the Implementation Survey, where information on which outcome measures have been identified are often sketchy or non-existent. Ironically, though the importance of discussing the value of the CAI impact is most certainly a priority item, the components needed to conduct such as assessments are largely overlooked or postponed.

In summary, results of analyses involving all CAI network systems suggest that, in general, teachers are favorable to utilizing CAI network systems, but problems inherent in any new program, particularly in a start-up year, need to be resolved. These problems typically involve implementation activities: training, preparation, coordination, proper staffing, support services, etc. Moreover, in many situations, human resources constitute a key factor. Specifically, the teacher survey results have identified at least two major areas in which teachers need assistance:

(1) integration with existing curricula, and

(2) proper use of CMI features.

Comparative Findings by Type of CAI Network System

Subsequent analyses, by type of CAI network system, reveal a host of common perceptions among teachers who refer their students to weekly networked CAI sessions.[3] When results are indicative of differences among CAI network systems, such variability are confounded somewhat by differences in teacher type (i.e., grade level taught).

(1) CAI within existing network system environments, are used primarily in a supplementary role. All five CAI network types are characterized by heavy reliance of CAI as supplementary instruction to classroom activities (Figure 2).

(2) For all network systems, and for IBM AND PLATO, in particular, CAI is used largely as a remedial activity (Figure 3).

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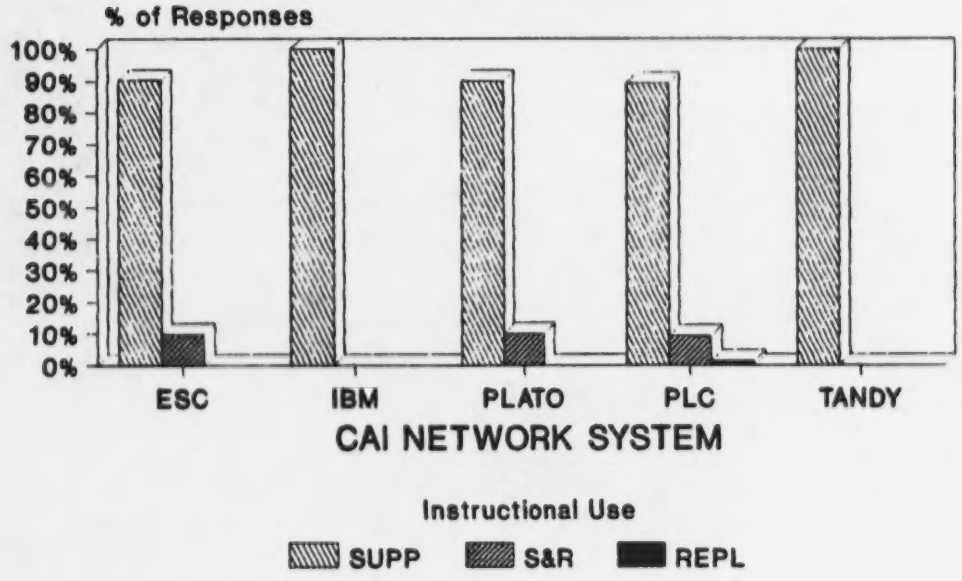
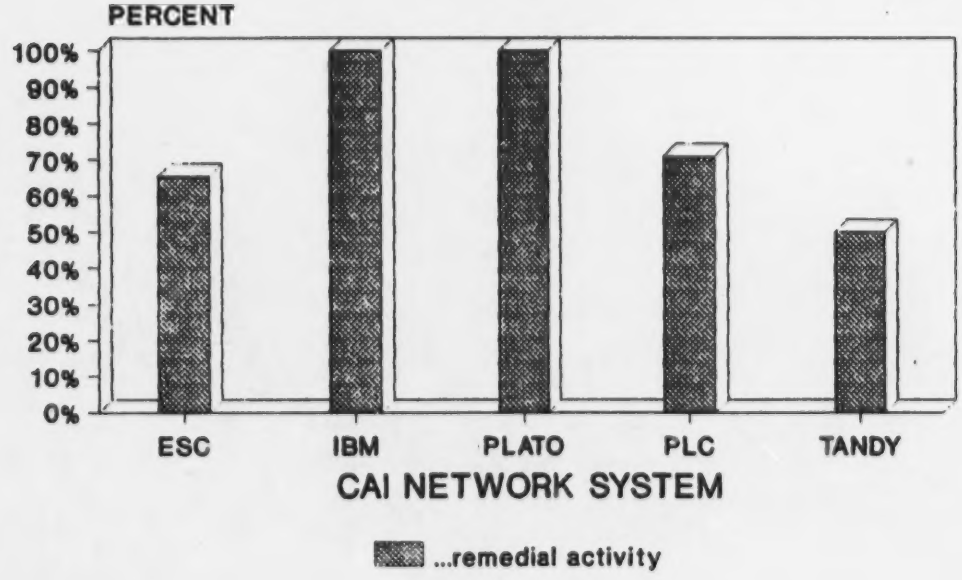
[3]The reader is again cautioned that for PLATO, TANDY, and IBM in particular, results are based on far fewer respondents than for ESC and PLC, and teachers were not explicitly asked to compare one network system to another.

FIGURE 2
Percent of various instructional uses
by CAI network system



Frequency Missing: 18

FIGURE 3
Percent using as remedial activity
by CAI network system



Frequency Missing: 14

(3) For ESC especially, and somewhat less so for other systems, CAI is used as a normal developmental activity (Figure 4).

(4) CAI is also used as an enrichment activity in four of the five network systems (Figure 5).

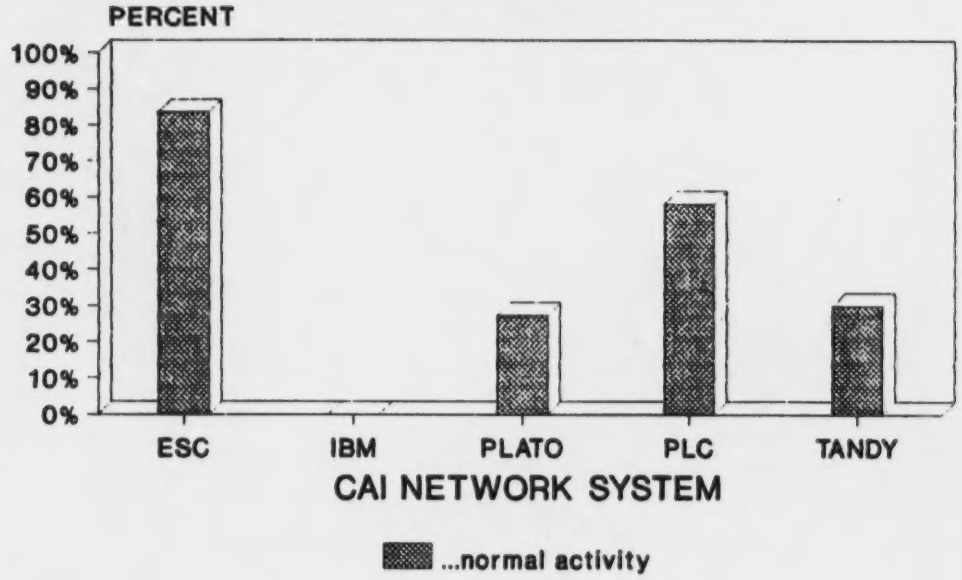
(5) Teachers in all network systems indicate they need help in integrating CAI and utilizing the CMI component (Figures 6 and 7).

(6) Teachers who reported not feeling comfortable using computers to deliver instruction are not clearly differentiated by the type of network system or hardware being used. That is, they seem to feel uncomfortable with computers, in general, and not with a specific network system. This finding is consistent with Tolham and Allred's (1984) implication that teachers, especially the elder constituents, are reluctant to experiment with CAI because of little or no formal, pre-service training.

(7) Mean average ratings of items on the teacher survey, by type of network system, tended to cluster, and resulted in similar favorable ratings for many items (Figure 8). For example, all systems are characterized by teachers as providing individual self-paced instruction [variable (V)5] or being accurate in content [variable (V)15]. Differences are evident on several items, but often it involves extreme ratings of IBM's CAI network system, where only two teachers served as participants. Consequently, average ratings for IBM were less stable than other CAI network systems, and despite receiving high ratings on several items of interest, IBM also received the dubious distinction for receiving the lowest ratings on a number of other concerns (e.g., appropriateness of outcome measures, accuracy in placement, and thoroughness of documentation). Further analysis of patterns in ratings reveal that teachers who used the PLATO and ESC systems more often gave the most favorable ratings. On the other hand, ratings for Tandy were relatively low, more often than not. Tandy's lower ratings are not surprising, in light of differences in technology level (equipment is older, relatively less sophisticated).

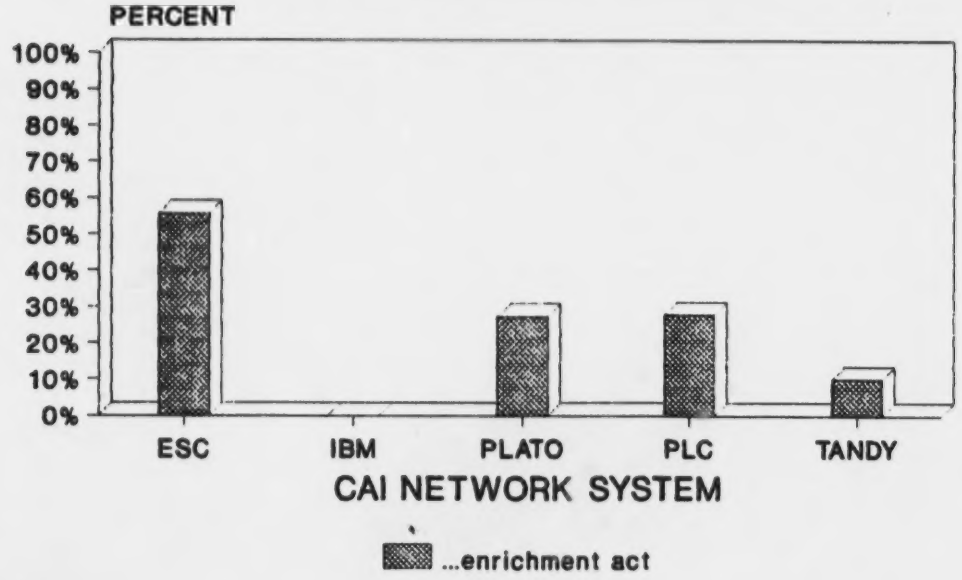
(8) Mean effectiveness ratings were also analyzed (Figure 8) with regard to training (V27), hardware (V28), and courseware (V29). These average ratings tended to cluster around the scales' midpoint (3.0). Best ratings for training (by vendor and/or DOE personnel) were received by IBM, PLATO and ESC respectively, all just above the scales' midpoint. Effectiveness ratings for hardware used were above the scales' midpoint for all five network

FIGURE 4
Percent using as developmental activity by CAI network system



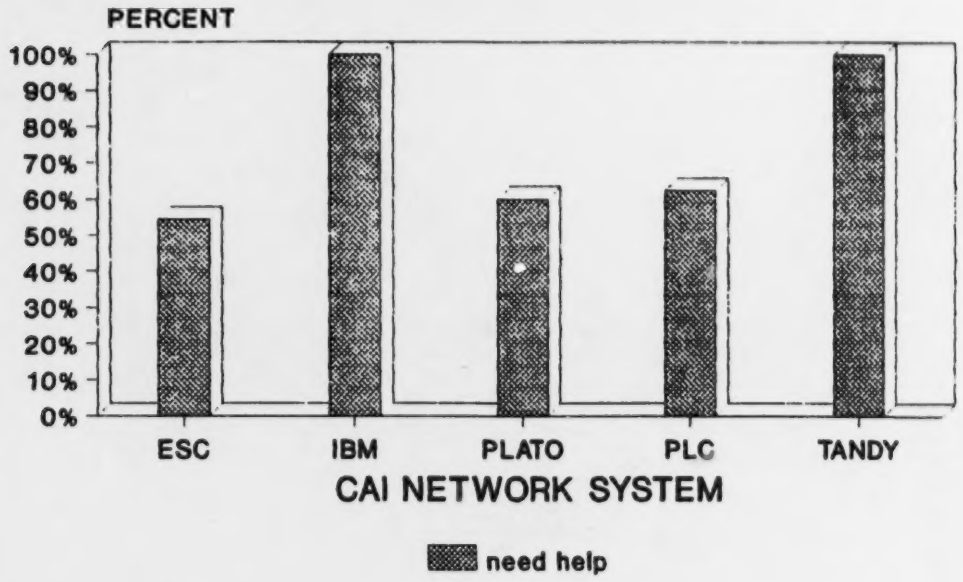
Frequency Missing: 14

FIGURE 5
Percent using as enrichment activity by CAI network system



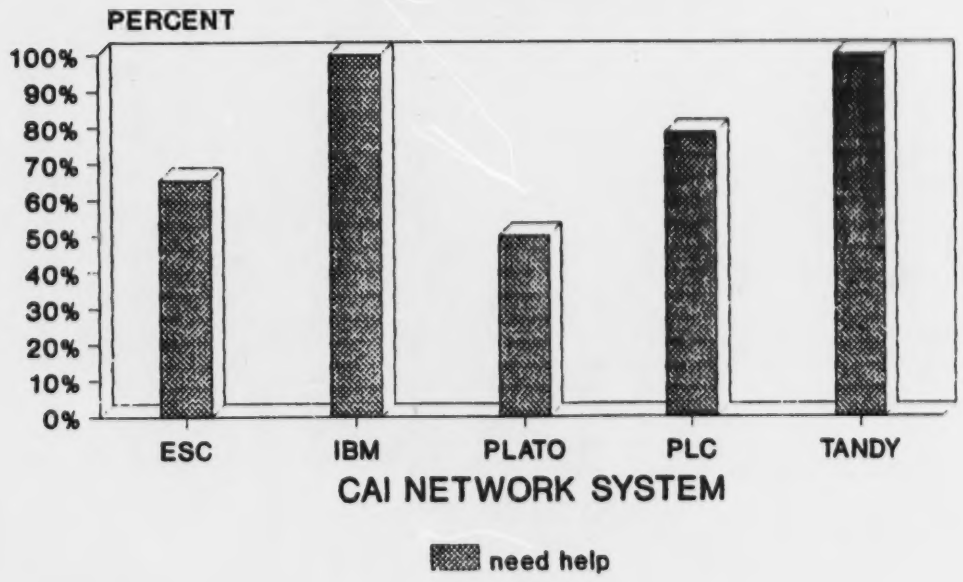
Frequency Missing: 14

FIGURE 6
Percent needing help with integration
by CAI network system



Frequency Missing: 17

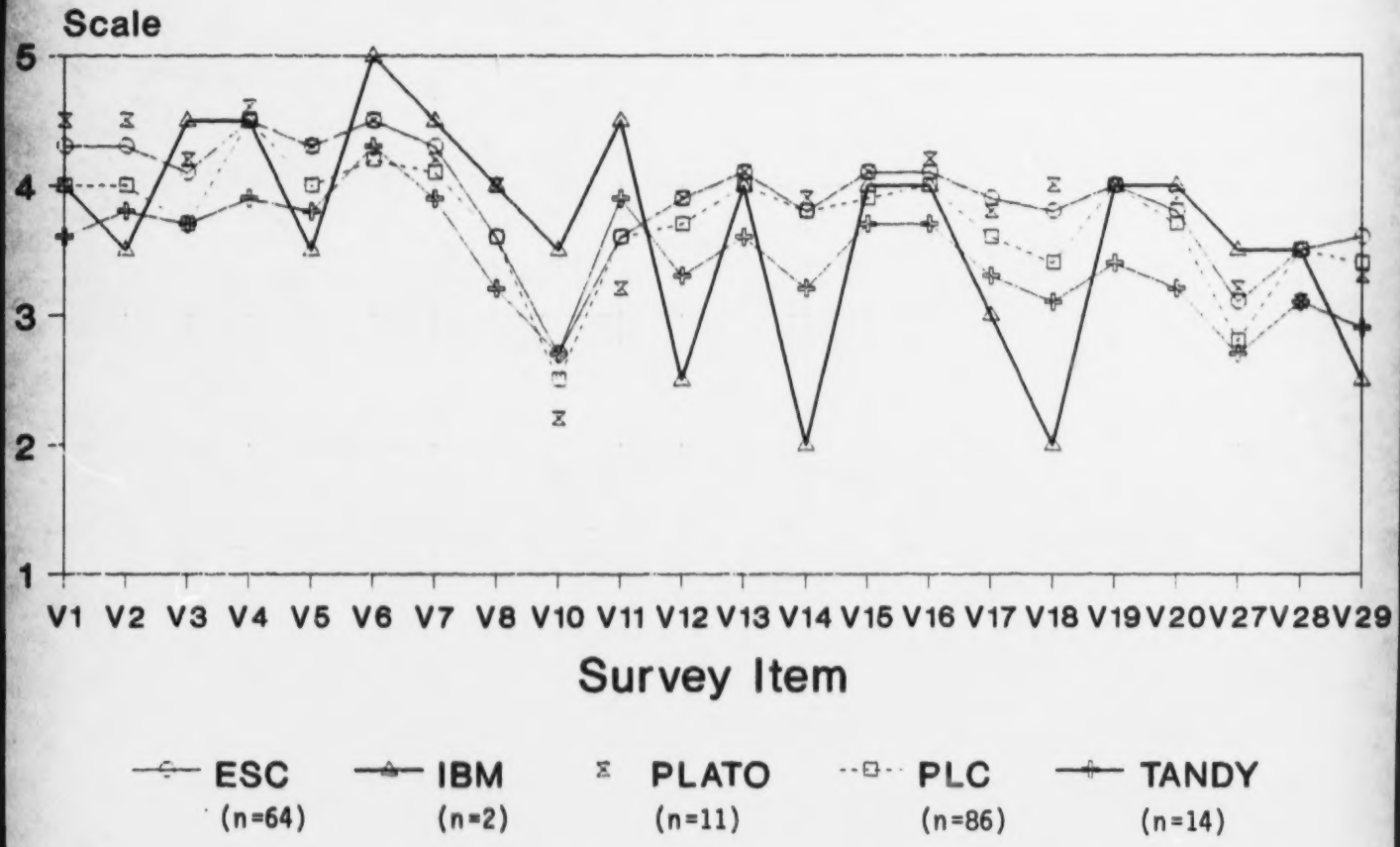
FIGURE 7
Percent needing help with using CMI
by CAI network system



Frequency Missing: 16

FIGURE 8

Mean ratings of teacher survey items by CAI network system



systems, with ESC, IBM, and PLC receiving highest ratings. Finally, effectiveness ratings for courseware, or instructional software, were highest (and above midpoint) for ESC, PLC and PLATO respectively.

Comparative Findings by Teacher Type (Grade Level Taught)

Elementary and secondary grade level teachers seem to have much in common in their perceptions of networked CAI programs. Several important differences, though, also seem apparent.[4]

(1) More secondary school teachers than elementary school teachers disagree with, or are undecided with, the statement, "The CAI network system installed at our school enhances student interest in learning" (Figure 9, V6). A similar pattern exists for the statement, "The CAI Network System installed at our school helps foster positive student attitudes towards learning" (Figure 9, V7).

(2) Overall, mean ratings of items on the teacher survey, by grade level taught, tended to cluster very closely (Figure 9). Elementary teachers tended to give slightly higher (more favorable) ratings for effectiveness of the courseware (V29).

(3) Both elementary and secondary school teachers use networked CAI as supplementary instruction, but at the secondary school sites sampled, all teachers apparently use CAI as a remedial activity (Figure 10), while far fewer teachers use CAI for normal developmental or enrichment activity. On the other hand, at the elementary school level, teachers are more inclined to utilize CAI for all three purposes more evenly.

(4) A quarter of the elementary school teachers indicated they do not feel comfortable with using computers to deliver instruction (n=29). Another 17% of the secondary teachers indicated similar discomfort (n=6). Most, however, report feeling fairly comfortable with CAI.

(5) Interestingly, in further cross-tabulation analysis of teachers' comfort level using computers to deliver instruction and teachers indicating whether help is needed, again, nearly a quarter of those who say they don't feel

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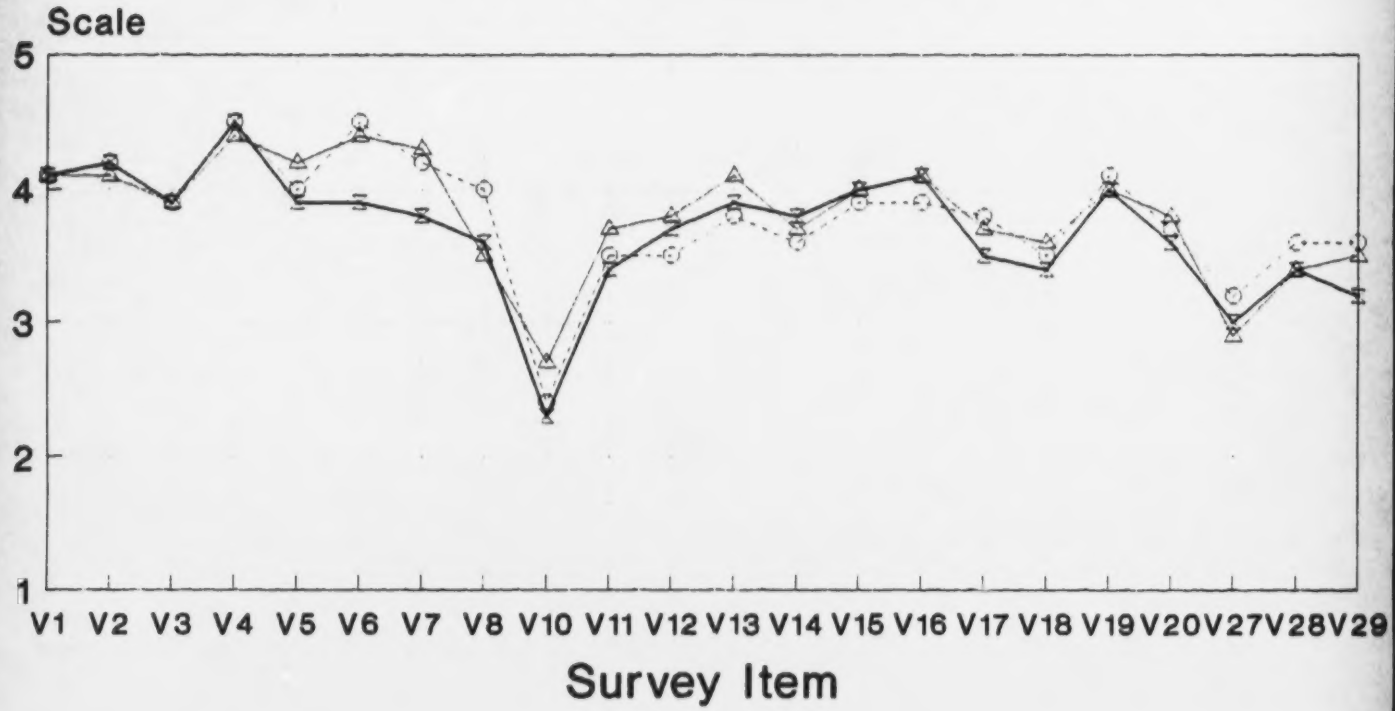
[4]A fair number of teachers either did not report their grade level, or taught across multiple grade levels to the extent that it was not possible to discretely categorize them into elementary or secondary levels. For this reason, some of the ensuing figures include a third category "Grade Unk."

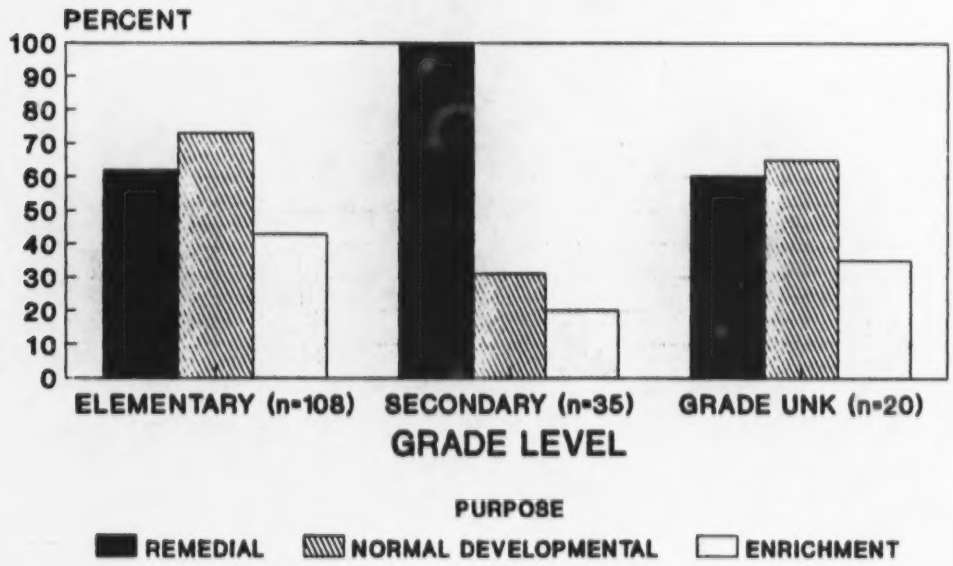
FIGURE 9

Mean ratings of teacher survey items by grade level divisions



Grade unk = grade levels not reported

FIGURE 10
Purpose of CAI network system by grade level division



Frequency Missing: 14

comfortable with using the computers also don't want assistance in integrating CAI lessons with classroom instruction (n=9 of 38 total).

C. Profiles of CAI Network Systems

General Comments

One of the main thrusts of the present evaluation is to provide profile descriptions of CAI network systems in operation at Hawaii public school sites. Profiles were constructed for six networked CAI programs that were operating during SY 1987-88:

Computer Curriculum Corporation (CCC), Palo Alto, CA
Educational Systems Corporation (ESC), San Diego, CA
PLATO, Minneapolis, MN
International Business Machines (IBM), Atlanta, GA
Prescription Learning Corporation (PLC), Phoenix, AZ
Tandy, Fort Worth, TX

Some qualifying statements are as follows:

(1) "TARGET AUDIENCE" (grade level and student type) is dependent on purpose/objective as well as courseware. Though the courseware may have been originally designed for, say, grades 3-8, if the purpose for utilizing the CAI was enrichment, a school might target grades K-2, gifted/talented students, or for remediation, grades 9-12 (and adult), basic skills classes.

(2) "PURPOSE" as described for each system is based on available information collected from schools, district personnel and vendor.

(3) "INSTRUCTIONAL SOFTWARE", or courseware, areas are listed, but this is an area in dire need of systematic revision to ascertain scope, depth, quality, and potential target audiences.

(4) "CMI AVAILABLE?" All network systems utilizing CAI should be equipped with high quality, easy-to-use CMI features. The logistical and time-saving advantages of securing centralized CMI is a mainstay of CAI network systems.

(5) "HARDWARE COMPATIBILITY" is not necessarily a complete listing of possible brands and models. Vendors are constantly attempting to expand the array of compatible hardware, but compatibility is not always possible without some compromise or adjustment. Care should be taken in fully researching new alternatives.

(6) "COSTS AND CONTRACTUAL ARRANGEMENTS" are rough estimates at best. Attention should be paid to details of the contract agreement to avoid possible complications later. Recurring costs such as maintenance, repair and courseware updates are especially difficult to pin down.

(7) "IMPLEMENTATION" data are based on the Implementation Survey results.

(8) "EFFECTIVENESS RATINGS" are based on the User Survey: Teacher results.

Profile Descriptions

(See Profile Sheets; Tables 10 - 15).

D. Recommendations

1. Re-double efforts to carefully **plan and coordinate** future implementation of CAI network systems. Schools need an explicit, strong support system, with continuity in planning. Improve communication among state, district, school and the Computers In Education Committee so that everyone can be kept abreast of developments, problems, and solutions. Coordination among vendor, principal, teachers, lab attendant and lab coordinator (if available) is crucial.

   a. Provide flexibility in procurement procedures to avoid delays and neutralizing the intent of a field-test. The ultimate goal is to identify the benefits and shortcomings of a variety of existing systems so that savings may be realized in the long run. Furthermore, CAI is a rapidly changing field. We should avoid inadvertently locking ourselves into old technology as a result of semantic traps. The term "computer equipment" may soon be obsolete given innovations such as optical disc technology that expand the efficiency of CAI, but do not necessarily fit the terminology utilized in budget, accounting or procurement.

   b. Although flexibility and autonomy in decision-making is useful for selection and procurement of CAI network systems, the process through which such decisions are made could be facilitated if key information is made available, roles and responsibilities among support personnel are clarified, and basic management guidelines provided.

2. Encourage the use of **lab attendants**, especially if a teacher or educational aide position is not assigned to the lab as support staff. As a general rule, teachers should not be expected to

Table 10

CAI NETWORK SYSTEM
PROFILE SHEET:
Computer Curriculum Corporation (CCC)

TARGET AUDIENCE:
Grade levels: K-12, Adult
Student types: Cross section

PURPOSE:
Remedial, normal development, enrichment

INSTRUCTIONAL SOFTWARE CONTENT AREAS:
Math, Reading,
Language Arts, Computer Programming

TYPICAL WEEKLY CAI SCHEDULE:
Varies: 10 min., 5x week; 25 min., 2x week

COMPUTER MANAGED INSTRUCTION (CMI) AVAILABLE? [Yes]

HARDWARE COMPATIBILITY:
Atari (workstation)
CCC Microhost (file server)

WORKSTATION STAND-ALONE CAPABILITY: [No]

COSTS AND CONTRACTUAL ARRANGEMENTS:
Costs:
Average Annual Cost: $51,933
No. Workstations: 32
Approximate Average Annual Cost Per Workstation
(Purchase, figured over 5 year span): $1623

Contract Agreement:
- o Lab attendant not included
- o Includes 800 toll free hotline
- o Both hardware & software purchased

IMPLEMENTATION:
Installation problems: 1 of 3 sites reported delay
System reliability:
- o average number of breakdowns in first three months: 4.3
- o 1 of 3 sites reported software problems

EFFECTIVENESS RATINGS (BY TEACHERS): N/A

HIGHLIGHTED COMMENTARIES

1. Lab attendant instrumental in ensuring success of CAI network program.
2. No local representative resident in Hawaii; someone must be flown in to trouble shoot.
3. Homework assignments may be produced for individual students.
4. Only network system in Hawaii Public schools implemented to network across schools as well as across workstations.
5. System breakdowns during first three months due in part to electrical outages. Older schools may eventually require electrical re-wiring.

Table 11

CAI NETWORK SYSTEM
PROFILE SHEET:
Educational Systems Corporation (ESC)

TARGET AUDIENCE:
Grade levels: K-8
Student types: Cross section

PURPOSE:
Remedial, normal development, enrichment

INSTRUCTIONAL SOFTWARE CONTENT AREAS:
Math
Reading

TYPICAL WEEKLY CAI SCHEDULE:
16 to >30 min., 2x week

COMPUTER MANAGED INSTRUCTION (CMI) AVAILABLE? [Yes]

HARDWARE COMPATIBILITY:
Tandy
Apple
IBM

WORKSTATION STAND-ALONE CAPABILITY: [Yes]

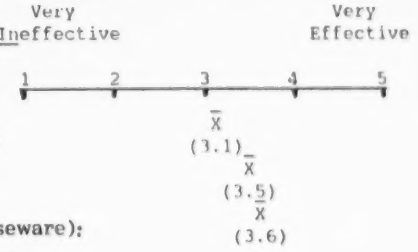
COSTS AND CONTRACTUAL ARRANGEMENTS:
Costs: Dependent on hardware and procurement arrangement:
Example. Nanakuli Elementary
Average Annual Cost: $58,000
No. Workstations: 32
Approximate Average Annual Cost Per Workstation
(Lease, figured over 5 year span): $1813

Contract Agreement:
- o Typically includes one lab attendant (1st year only - for Windward District)
- o includes one 800 toll free hotline (1st year only)
- o Software lease: [3 years]
  Hardware lease: [4 years]
- o Option to buy out lease available? [Yes]
- o Hardware can be purchased for fee of $1.00 after 4th year
- o Maintenance cost inclusive if lease; if buy out option executed, maintenance fee = 15% of purchase price

Note. ESC has made changes in contract arrangements in 1988 (e.g., software may now be purchased, price structure modified).

IMPLEMENTATION:
Installation problems: 0 of 4 sites reported problems
System reliability:
- o average number of breakdowns in first three months: 1.5
- o 2 of 4 sites reported software problems

EFFECTIVENESS RATINGS (BY TEACHERS):



key: $\bar{X}$ = Mean Average Rating

HIGHLIGHTED COMMENTARIES

1. Lab attendant instrumental in ensuring success of CAI network program.
2. Speed of access time to lessons good.
3. Support service and reported follow-up on problems good.
4. CMI potential underutilized; schools need assistance with keeping database of student information stored in file server (e.g., info on norm-reference and criterion-reference test performance could be stored with ESC diagnostic test data, by individual student).
5. Peripheral devices such as the CD-ROM, mice, & voice synthesizer improve quality of network system.
6. Need to explore extent of compatibility when using Apple & IBM hardware
7. Need to assess cost effectiveness of ESC system, particularly since cost of ESC is highest among all CAI networks reviewed in the present evaluation study.

Table 12

CAI NETWORK SYSTEM
PROFILE SHEET:
International Business Machines (IBM)

TARGET AUDIENCE:
Grade levels: K-8
Student types: Cross section

PURPOSE:
Remedial (normal development, enrichment also possible)

INSTRUCTIONAL SOFTWARE CONTENT AREAS:
Math, Reading,
Language Arts

TYPICAL WEEKLY CAI SCHEDULE:
>30 min., 5x week

COMPUTER MANAGED INSTRUCTION (CMI) AVAILABLE? [Yes]

HARDWARE COMPATIBILITY:
IBM

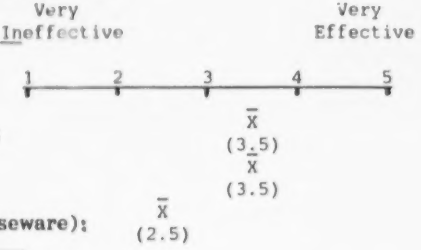
WORKSTATION STAND-ALONE CAPABILITY: [Yes]

COSTS AND CONTRACTUAL ARRANGEMENTS:
Costs:
Average Annual Cost: $12,199
No. Workstations: 20
Approximate Average Annual Cost Per Workstation
(Purchase, figured over 5 year span): $610

Contract Agreement:
- o Lab attendant not included
- o Both hardware & software purchased

IMPLEMENTATION:
Installation problems: 0 of 1 sites reported problems
System reliability:
- o average number of breakdowns in first three months: 1
- o 1 of 1 sites reported uncertainty if software problematic

EFFECTIVENESS RATINGS (BY TEACHERS):



key: $\bar{X}$ = Mean Average Rating

HIGHLIGHTED COMMENTARIES

1. High quality hardware; couseware seems limited (received lower ratings); need to further explore scope & quality of courseware.
2. CAI courseware originally designed for K-8, but could be used for remedial purposes as exemplified by Laupahoehoe's program.
3. Need to coordinate with IBM regarding installation of application programs (e.g., wordprocessing) in file server.
4. Cost estimates are conservative; recurring costs unknown
5. Only two school sites involved; one of the two schools failed to return both implementation and teacher surveys; difficult to determine generalizability of findings.

Table 13

CAI NETWORK SYSTEM
PROFILE SHEET:
Control Data Corporation (CDC) - PLATO

TARGET AUDIENCE:
Grade levels: 3-12
Student types: Cross section

PURPOSE: Remedial, normal developmental (enrichment also possible)

INSTRUCTIONAL SOFTWARE CONTENT AREAS:
Math, Reading, Language Arts, Science, Social Studies

TYPICAL WEEKLY CAI SCHEDULE:
>30 min., 1x week

COMPUTER MANAGED INSTRUCTION (CMI) AVAILABLE? [Yes]

HARDWARE COMPATIBILITY:
CDC

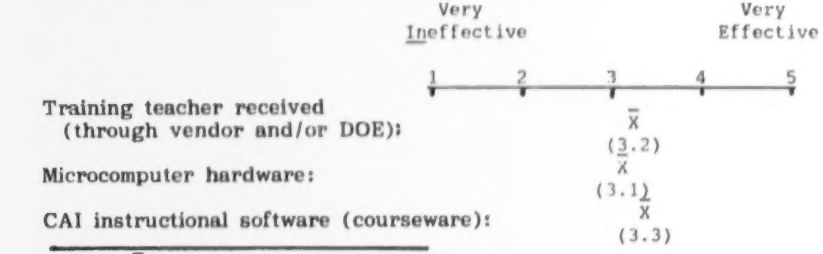
WORKSTATION STAND-ALONE CAPABILITY: [No]

COSTS AND CONTRACTUAL ARRANGEMENTS:
Costs:
Average Annual Cost: $24,767
No. Workstations: 15
Approximate Average Annual Cost Per Workstation (Purchase, figured over 5 year span): $1651

Contract Agreement:
- o Lab attendant not included
- o Both hardware & software purchased

IMPLEMENTATION:
Installation problems: 1 of 1 sites reported delay
System reliability:
- o average number of breakdowns in first three months: 24
- o 1 of 1 sites reported hardware problems

EFFECTIVENESS RATINGS (BY TEACHERS):



key: $\bar{X}$ = Mean Average Rating

HIGHLIGHTED COMMENTARIES

1. Teacher assigned to serve as lab coordinator; important to successful operations.
2. Speed was slow; students bored while waiting (numerous attempts at improving access time to lessons).
3. Workstations do not have stand alone capacity; can't use other software applications independently.
4. System undependable at present -- numerous problems.
5. Vendor assurances of increased speed made in late spring 1988.
6. Information based on only 1 school site; difficult to determine generalizability of findings.

Table 14

CAI NETWORK SYSTEM
PROFILE SHEET:
Prescription Learning Corporation (PLC)

TARGET AUDIENCE:
Grade levels: K-12
Student types: Cross section

PURPOSE:
Remedial, normal development, enrichment

INSTRUCTIONAL SOFTWARE CONTENT AREAS:
Math, Reading,
Language Arts

TYPICAL WEEKLY CAI SCHEDULE:
Varies: >30 min., 1x to 5x week

COMPUTER MANAGED INSTRUCTION (CMI) AVAILABLE? [Yes]

HARDWARE COMPATIBILITY:
Apple IIe (Workstation)
IBM (file server)

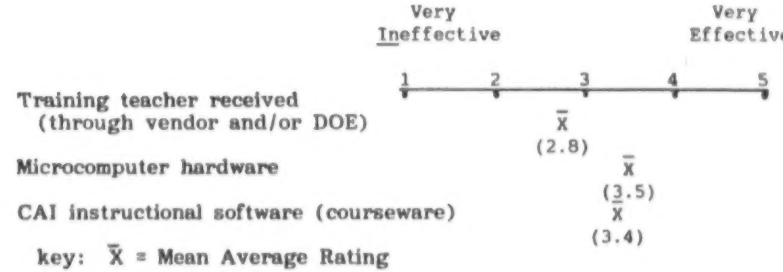
WORKSTATION STAND-ALONE CAPABILITY: [Yes]

COSTS AND CONTRACTUAL ARRANGEMENTS:
Costs: Dependent on hardware & procurement arrangement
Example. Aiea High
Average Annual Cost: $25,000
No. Workstations: 19
Approximate Average Annual Cost Per Workstation
(Lease,figured over 5 year span): $1316

Contract Agreement:
o Lab attendant not included
o Both software and hardware leased

IMPLEMENTATION:
Installation problems: 3 of 7 sites reported delay
System reliability:
o average number of breakdowns in first three months: 1
o 2 of 7 sites reported software problems, or uncertainty if software problematic.

EFFECTIVENESS RATINGS (BY TEACHERS):



key: $\bar{X}$ = Mean Average Rating

HIGHLIGHTED COMMENTARIES

1. Difficult to determine cost breakdown; flat fee in conjunction with "School within School" program (school site used by vendor after school hours on a for-profit basis).
2. Different contractual arrangements made with various school sites, sometimes at same costs, presumably due to differences in when system was installed (all PLC systems examined were installed in Summer or Fall 1987).
3. Need to clarify contractual arrangements for "School within School" concept, (e.g., if no profit then school must pay; vendor must be accountable for shortcomings such as late start-up acitivities).
4. Need clearer communication with vendor, follow-up on problems with network system.
5. Inherent disadvantage with students having to load and unload floppy diskettes from shelves, instead of automatic loading from file server.
6. Relatively inexpensive system, but cost-effectiveness unknown.

Table 15

CAI NETWORK SYSTEM
PROFILE SHEET:
Tandy

TARGET AUDIENCE:
Grade levels: K-12
Student types: Cross section

PURPOSE:
Remedial, normal development, enrichment

INSTRUCTIONAL SOFTWARE CONTENT AREAS:
Math, Reading,
Language Arts, Social Studies

TYPICAL WEEKLY CAI SCHEDULE:
Varies: 16-30 min., 2x to 5x week

COMPUTER MANAGED INSTRUCTION (CMI) AVAILABLE? [partial]

HARDWARE COMPATIBILITY:
Tandy TRS 80

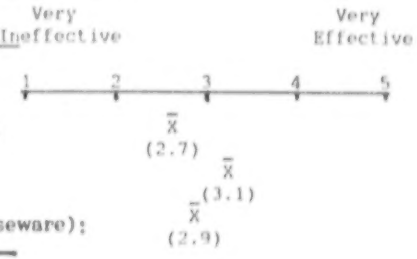
WORKSTATION STAND-ALONE CAPABILITY: [Yes]

COSTS AND CONTRACTUAL ARRANGEMENTS:
Costs: Dependent on hardware and procurement arrangement:
Example. Kalakaua Intermediate
Average Annual Cost: $5278
No. Workstations: 9
Approximate Average Annual Cost Per Workstation
(Purchase, figured over 5 year span): $586

Contract Agreement:
- o Lab attendant not included
- o Both hardware & software purchased
- o File server not equipped with hard disk

IMPLEMENTATION:
Installation problems: 1 of 2 sites reported delay
System reliability:
- o average number of breakdowns in first three months: 1.5
- o 2 of 2 sites reported software limitations
- o 1 of 2 sites reported hardware problems

EFFECTIVENESS RATINGS (BY TEACHERS):



key: $\bar{X}$ = Mean Average Rating

HIGHLIGHTED COMMENTARIES

1. Network systems reviewed were relatively old; some difficulty getting updated courseware for outdated hardware (workstations are TRS-80s).
2. Procurement was somewhat atypical; Lanai's Tandy lab was largely donated, and Kalakaua Intermediate's Tandy lab was inherited from Stevenson Intermediate.
3. Need to review more updated Tandy CAI network laboratories such as the facility being field-tested at Waipahu High School.
4. Only two school sites involved; clear differences existed in purpose, target population, costs, and network systems; difficult to determine generalizability of findings.

load/unload modules and operate the CMI component. Coordination is needed between teacher and lab staff to allow for adjustments in curriculum sequence if necessary.

(3) Use networked CAI primarily, if not exclusively, as **supplemental instruction**. CAI seems best used to complement text, materials, and classroom activities. Teachers should accompany their students where possible to gain insights into how best to use the CAI and CMI programs to students' advantage.

(4) Provide **training** opportunities for staff, especially for teachers to learn more about the system's capabilities via CMI to monitor performance and individualize instruction based on students' strengths and weaknesses. More efficient use of CMI is needed to maximize the potential of CAI. CMI can keep records of students' progress and test information. Some CMI programs can accommodate monitoring of additional instruments and evaluation information such as special instructional needs and enrollment in special programs.

(5) Encourage schools to explore how best to **integrate** networked CAI activities with classroom instruction.

(6) Consider establishment of a **study team** or contracting **independent reviewers** to assist in content analysis of scope, depth and quality of existing CAI courseware, and consistency with Hawaii's curriculum foci. Identify clearinghouses and other sources that will aid schools in identifying suitable systems for their particular purposes. Consider utilizing the computer review center and clearinghouses to aid educators in identifying and purchasing quality software that are more than a "book on a screen."

(7) **Directions** for CAI network may best be guided by what schools need. Look into possibilities such as developing networked CAI curricula designed to assist in passing minimum competency tests (e.g., HSTEC). (cf, Washington State's agreement with ESC to develop special CAI lessons [simulations] based on curriculum specialists' help in Washington's schools)

(8) Continue to **research** CAI network systems. The current market is characterized by marked improvements in CAI content and delivery. It may not be wise to depend solely on familiar brand names. Given the potential sizeable outlay of funds in purchasing additional CAI network systems (there are at least 30 networked labs in Hawaii as of June 1988, not including ECIA Chapter I labs), careful formative and summative evaluations, should be conducted, if at all possible. Research the possibility and utility of an "educational impact" study to help analyze what effects would be anticipated should large-scale expansion of CAI network systems be implemented.

V. CONCLUSIONS

1. What **ingredients** appear to be **crucial** in establishing and operating a "successful" CAI network learning environment? This is a difficult question to address straightforwardly, but some preliminary analyses do point to key elements essential to accomplishing an efficient network system.

   a. Most important of all is management. Proper planning, coordination and resource management, are crucial to operational efficiency. Many problems or barriers can be avoided given time to prepare for researching courseware, budget planning, and class scheduling. The coordination among state, district, school, lab attendant and vendor support staff is also important. The communication line between teacher and lab attendant is critical to maximizing the individualized instruction possible when CAI is combined with CMI. Procuring the proper hardware compatible with the instructional software is another consideration of import. Hardware, and operating and instructional software vary in terms of speed, reliability and efficiency. Instructional software, in particular, should be reviewed and analyzed with respect to content emphasis and appropriateness for target students.

   b. Another general category of items that lay the foundations for successful CAI network systems include operational features. The selection of target students is the precursor to other decisions that need to be made appropriately. Goals and objectives should guide decisions resulting in which systems with what support staff, and conditions under which networked CAI is implemented. Important considerations include time-on-task class scheduling, integration with classroom activities, diagnostic placement and progress monitoring. Additionally, selection of a vendor with adequate support sevices is at times, an oversight not without severe consequence. Minimizing computer down-time should be a priority for all concerned. Further, the daily operational activities should not overshadow the need for on-going evaluation concerns. Problems and successes in implementation should be communicated via log sheets, monthly or quarterly summaries, or other means, to ensure feedback is issued to principals, lab coordinators and curriculum/computer education specialists. Moreover, a consistant finding in research is the desireability of using CAI as a supplement rather than a replacement of traditional instruction.

   c. Finally, but not necessarily least in importance, are training opportunities and the need to properly prepare school staff in

implementing CAI network systems. Experience has convinced many that in-service training **prior** to actual implementation is beneficial to many newcomers to CAI systems. Orientations for students **prior** to actual hands-on has also been found to be of value, expecially if the equipment is unfamiliar to youngsters. It cannot be emphasized enough, it seems, that adequate training is a sine qua non for maximizing teacher involvement and commitment as well as expertise. The full potential of CAI network systems will not be efficiently tapped without providing teachers the insights and support needed to enhance student learning experiences.

2. The six types of CAI network systems field-tested in Hawaii public schools during SY 1987-88 were characterized by prominent differences in hardware configuration, lab size, cost, contract arrangement and operation. The intent and focus of these systems also varied from site to site. Though many schools emphasized some form of basic skills or remediation activity for low achieving students, other schools either targeted all or a cross-section of its student population.

3. Virtually all of these network systems were new and installed by the respective vendors at 19 selected school sites across Hawaii's seven public school districts. Installation was successful at all school sites, but a number of schools reported delays in installing either the hardware or instructional software. In general, the implementation of these network systems can be characterized by similarity in network concept (single file server linked to multiple workstations), but vast differences abound with respect to coordination, schedule, use of CMI features, target students, courseware delivery, and management of lab operations. Provisions for lab attendants were made at some schools via the contract agreement, while at other schools, additional funds were used to hire an educational aide or teacher to serve as coordinator. Several schools were not furnished with a lab attendant or a designated teacher coordinator at all. In all probability, these latter schools were not able to utilize the full potential of the CAI and CMI components. Without assistance from a lab attendant or coordinator and without extensive training, few teachers could be expected to efficiently perform operational tasks required to customize CAI programming to suit individual students needs, or to utilize CMI features such as diagnostic testing or report generation on a weekly basis.

4. Although the descriptions of CAI network systems, as exemplified through the profile sheets, are more different than similar in many ways, the ratings by teachers of CAI benefits and effectiveness are not always measurably distinctive. Most teachers are clearly in favor of the CAI concept and of attempts to reap benefits of CAI not possible with traditional classroom environments. What remains unclear, though, are differences in the quality of CAI programs. To many, at this point, "anything is better than nothing," due to the

novelty and presumable privilege of piloting a CAI network system. What is not available, at present, is a systematic review of courseware quality and comparative worth of individual network systems with respect to delivery, learning outcomes and cost-effectiveness.

5. Numerous problems were experienced by schools in the start-up activities of this first year of implementation. Many of these problems were possibly due to the limited time made available to district and school staff for proper planning and preparation in instituting a new program. Most schools were notified in late spring to accommodate installation and field-testing of new CAI network systems. Nevertheless, all except one of the 19 schools were able to institute CAI on a networked basis. The extent to which each school was successful in utilizing the full potential of the CAI/CMI system is unknown, but it is probably safe to say that none of the schools has extensively tapped the capabilities of CAI network systems.

6. What general observations then, can be made after the conclusion of the initial year of implementation? Perhaps the most general statement that could be made is that CAI network systems are operating at all school sites with the exception of Mililani High, whose apparent objective was to deliberately omit CAI as the primary intent of the networked lab. (It is not clear, however, why CAI software was eventually purchased for SY 1988-89, as completed surveys were not received). In spite of the claim that a total of 18 school sites are up and running, there clearly are areas in which improvement can be made to increase efficiency. Goals and objectives need to be clearly conveyed to all support personnel. Training should be provided, based on each school's identified needs. Planning and preparation activities need to be coordinated among policy-making agents (e.g., Computers In Education committee), managing agents (e.g., state and district personnel), and implementing agents (e.g., teacher, lab coordinators).

7. How extensive are planning and evaluation preparations at school sites? Very frankly, clear conclusions as to the relative impact and effectiveness will be difficult to obtain under present conditions. There are few schools with clear objectives and explicit outcome measures or data collection procedures. No overall design is reflected in the implementation scheme. Even the entire body of CAI research provides little with respect to unequivocal findings based on sound, vigorous methodology. Networked CAI too, is relatively new, and data from independent sources will not be forthcoming for some time.

8. The common element that threads through all forms of CAI is the attempt to provide a viable instructional or training strategy that may complement existing educational approaches. Moreover, there are several inherent advantages in utilizing CAI in lieu of, or as a supplement to traditional classroom instruction.

a. First and foremost, CAI is capable of providing what is impossible for the typical classroom teacher who rarely is afforded the opportunity to furnish individual instruction to each student. It is economically unfeasible to secure one-to-one tutelage, and not even desirable for certain learning experiences. However, when the need does arise, the CAI approach is an alternative increasingly sought and utilized.

b. Second, memory lapses are rare and impatience non-existent with regard to delivery of CAI.

c. Third, the quality of certain CAI "courseware" has improved to the point where visual images and synthesized auditory stimuli provide economical, yet functional and realistic representation of inventive or natural phenomena (e.g., flight simulation, chemical reactions).

There are certainly other benefits that could also be mentioned, but it should be clear that CAI is not without its own limitations. The most significant among these may be the cold reality that beneath it all, computers are machines that, in spite of references to "artificial intelligence or expert systems," ultimately depend on human input. Ergo, garbage in...garbage out. There are also areas in which present CAI is generally inadequate or inappropriate, such as the human warmth and supportive tutelage critical to fostering socio-cognitive skills, civic responsibility, morality,and other areas of affective education.

For the present, it is hoped that the current evaluation effort will be of value to decision-makers at all levels. Principals and district specialists will hopefully find benefit in reviewing the profile descriptions of existing CAI network systems. The overview of essential ingredients of a "successful" system may be of interest to school staff and support personnel as well as policy-makers. The documentation of this limited state-wide field-test, in general, can be of value in planning future directions for CAI network systems in Hawaii public schools.

We do seem to be treading on a threshold of a new era. Rapid advances in technology, and reduced costs, coupled with well researched and orchestrated courseware holds more than a glimmer of promise for some truly dramatic improvements in educational delivery. Traditional classroom instruction has its merits, but its shortcomings have perhaps been prolonged inordinately by economic necessity.

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APPENDIX A

COMPUTER-ASSISTED INSTRUCTION
NETWORK SYSTEMS

IMPLEMENTATION SURVEY

School _____ School Code ___ ___ ___

Submitted by _____ (Name)

[ ] Principal [ ] Teacher [ ] Coordinator

District [ ] Honolulu [ ] Hawaii [ ] Central [ ] Maui [ ] Leeward [ ] Kauai [ ] Windward

Phone _____

Instructions: Please complete the following items as best you can. Information for certain items may require you to consult your CAI vendor or another individual at your school.

HARDWARE

Computer Brand, File Server

[ ] Apple [ ] Control Data Corp.
[ ] IBM [ ] Other (describe)_____
[ ] Tandy _____

No. File Servers _____ Monitor: [ ] Color [ ] Mono

Printer Brand

[ ] Apple
[ ] Epson
[ ] IBM
[ ] Okidata
[ ] Tandy
[ ] Other_____

Type Printer — Quantity
[ ] DOT-Matrix _____
[ ] Letter Quality_____

Computer Brand, Work Stations

[ ] Apple [ ] Control Data Corp.
[ ] IBM [ ] Other (describe)_____
[ ] Tandy _____

No. work stations _____ Monitor: [ ] Color [ ] Mono

Peripherals, File Server

[ ] CD-ROM [ ] Video Disk
[ ] Interactive Video [ ] Graphic File Server

Peripherals, Work Stations

[ ] Mouse [ ] Voice Synthesizer
[ ] Ear phones

Component Characteristics

File Server: Storage Capacity?
[ ] 10 MB or less
[ ] 11-20 MB
[ ] 21-40 MB
[ ] Over 40 MB

Work stations: Graphics capability:
[ ] Yes [ ] No

Purchase/Lease Agreement

[ ] Purchase
[ ] Lease with option to buy
[ ] Lease

Duration of Agreement

(If leased) _____Years

Warranty Period (If purchased)

[ ] 90 days or less [ ] Over one year
[ ] 91 days - one year

SOFTWARE

CAI Proprietorship

[ ] CCC [ ] MAC
[ ] ESC [ ] PLATO
[ ] IBM [ ] PLC
[ ] IDEAL LEARNING [ ] TANDY
[ ] Other _____

Focus Area (check all that apply)

[ ] Basic skills
[ ] Regular curriculum
[ ] Special topic

CAI Courseware Content:

Programs by Subject and Grade

For each subject area networked on CAI, mark an "X" for each grade level in which CAI is available.

SUBJECT	GRADE												
	K	1	2	3	4	5	6	7	8	9	10	11	12
Math													
Reading													
Lang. Arts													
Science													
Social Studies													
_____													

Purpose (check all that apply)

[ ] Remedial
[ ] Normal Developmental
[ ] Enrichment

Format of CAI Programs (check all that apply)

[ ] Drill and practice
[ ] Tutorial
[ ] Simulation
[ ] Interactive Video
[ ] Educational Games
[ ] Other (describe) _____

Computer-Managed Instruction (CMI) features:

	Available?			Utilized currently?			Anticipate use in future?		
	Yes	No	Unsure	Yes	No	Unsure	Yes	No	Unsure
a. Student testing	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
b. Diagnostic placement level	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
c. Prescriptive activities	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
d. Records management	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

OPERATIONS

Implementation, Network System

	Yes	No	Unsure	Comments
a. Any significant installation problems?	[ ]	[ ]	[ ]	
b. Was installation promptly completed?	[ ]	[ ]	[ ]	
c. Is level of vendor support adequate?	[ ]	[ ]	[ ]	
d. Is CAI Network System reliable?	[ ]	[ ]	[ ]	
° Number of breakdowns, or system failures in first three months of use	_____			
e. Any significant hardware problems?	[ ]	[ ]	[ ]	
f. Any significant software problems?	[ ]	[ ]	[ ]	
g. Can other CAI programs be installed on existing network?	[ ]	[ ]	[ ]	
h. Can hardware be used for other applications besides CAI?	[ ]	[ ]	[ ]	

End-User Information

Average (mean) number of teachers who refer students to CAI network

(Weekly average) _____

Average (mean) number of students who use CAI network

(Weekly average) _____

Approximate number of teachers who utilize CMI functions

	No. Teachers
Computer testing	_____
Placement diagnosis	_____
Prescriptive programming	_____
Records management	_____

No. of students per work station in typical session:

[ ] 1
[ ] 2
[ ] 3 or more

Length of typical CAI network session

Min./session	Times/week
[ ] 1-10	[ ] 1
[ ] 11-15	[ ] 2
[ ] 16-20	[ ] 3
[ ] 21-25	[ ] 4
[ ] 26-30	[ ] 5
[ ] > 30 min.	

Physical setting of CAI network

[ ] In laboratory (separate room)
[ ] Within self-contained classroom
[ ] Shared by more than one classroom

Who coordinates use of CAI network?

[ ] Lab assistant
[ ] Teacher, assigned as coordinator
[ ] Principal
[ ] Each classroom teacher (no coordinator)

Why was this particular CAI Network System selected? _____

_____

_____

Who selected this particular CAI Network System?

[ ] School Computer Committee
[ ] School Administration
[ ] School Teaching Staff
[ ] District Administration/Staff
[ ] State Administration/Staff
[ ] Don't know

COSTS

Hardware

	Unit Cost		Qty.		Total
File server	_____	x	_____	=	$_____
Work station	_____	x	_____	=	_____
Printer	_____	x	_____	=	_____
Peripherals & other (e.g., cables)					_____
TOTAL HARDWARE COSTS					$_____

Hardware costs reflect: [ ] purchase [ ] lease

Software

CAI software	$_____
Network software (incl. operating system)	_____
TOTAL SOFTWARE COSTS	$_____

Software costs reflect: [ ] purchase [ ] lease

TOTAL

Hardware	$_____
Software	_____
All other costs (transportation, maintenance, training, lab assistant, etc.)	_____
TOTAL CAI NETWORK COSTS	$_____

Average annual costs: $ _____

TRAINING

Were teachers provided in-service training? [ ] Yes [ ] No [ ] Unsure

If "yes"... number of teachers who received training in 1987? _____

Who provided training? [ ] Vendor
[ ] School staff
[ ] District Computer Education Specialist
[ ] Contractor, independent

Total hours of training received by teacher? _____ hours

Are there further needs for training? [ ] Yes [ ] No [ ] Unsure

If "yes"... briefly describe needs of highest priority:

Need 1 _____

Need 2 _____

Need 3 _____

PLANNING AND EVALUATION

What is the primary purpose for utilizing a CAI network at your school? _____

_____

Are there any outcome objectives identified? [ ] Yes [ ] No [ ] Unsure

If "yes"... please list those of highest importance:

Objective 1 _____

Objective 2 _____

Objective 3 _____

(Attach additional sheet if necessary)

Have outcome measures been identified? [ ] Yes [ ] No [ ] Unsure

If "yes"... please list _____ _____

_____ _____

Describe target student population(s) _____

Have data collection procedures been established to determine extent to which outcome objectives have been met? [ ] Yes [ ] No [ ] Unsure

COMPUTER-ASSISTED INSTRUCTION NETWORK SYSTEMS

User Survey: TEACHER

School	School Code __ __ __
Submitted by	Telephone
Grade levels I teach in which CAI Network is used:	

District (please check):

[ ] Honolulu [ ] Hawaii
[ ] Central [ ] Maui
[ ] Leeward [ ] Kauai
[ ] Windward

Instructions. Please indicate the degree to which you agree or disagree with the following statements.

SA = Strongly Agree
A = Agree
U = Undecided
D = Disagree
SD = Strongly Disagree

The Computer-Assisted Instruction (CAI) Network System installed at our school . . . .

		SA	A	U	D	SD
1.	... is useful in helping my students learn efficiently.	[ ]	[ ]	[ ]	[ ]	[ ]
2.	... is useful in helping my students improve their (academic subject) skills.	[ ]	[ ]	[ ]	[ ]	[ ]
3.	... helps in improving the delivery of instruction.	[ ]	[ ]	[ ]	[ ]	[ ]
4.	... provides individual instruction where pace and sequence are controlled by the student.	[ ]	[ ]	[ ]	[ ]	[ ]
5.	... provides an effective means of instruction to students.	[ ]	[ ]	[ ]	[ ]	[ ]
6.	... enhances student interest in learning.	[ ]	[ ]	[ ]	[ ]	[ ]
7.	... helps foster positive student attitudes towards learning.	[ ]	[ ]	[ ]	[ ]	[ ]
8.	... is sometimes better than traditional classroom instruction. (If you "agree" or "strongly agree" with item 8, briefly explain: _____)	[ ]	[ ]	[ ]	[ ]	[ ]

9. I use the CAI network programs to [ ] supplement [ ] replace [ ] supplement and replace coursework in the classroom.

		SA	A	U	D	SD
10.	I don't feel comfortable using computers to deliver instruction.	[ ]	[ ]	[ ]	[ ]	[ ]
11.	I would like assistance in integrating the CAI courseware with my classroom curricula.	[ ]	[ ]	[ ]	[ ]	[ ]
12.	The outcome measures (tests, quizzes) used to evaluate what my students learn through CAI are appropriate.	[ ]	[ ]	[ ]	[ ]	[ ]

The software programs resident in our CAI Network System . . . .

		SA	A	U	D	SD
13.	... are appropriate for my students' ability levels.	[ ]	[ ]	[ ]	[ ]	[ ]
14.	... provide accurate diagnoses for placing my students within the CAI program.	[ ]	[ ]	[ ]	[ ]	[ ]
15.	... are accurate in content.	[ ]	[ ]	[ ]	[ ]	[ ]
16.	... present contents in a well-organized, logical fashion.	[ ]	[ ]	[ ]	[ ]	[ ]
17.	... provide clear documentation (guides, manuals, etc.).	[ ]	[ ]	[ ]	[ ]	[ ]
18.	... provide thorough documentation.	[ ]	[ ]	[ ]	[ ]	[ ]
19.	... give my students clear and easy-to-follow directions on the screen.	[ ]	[ ]	[ ]	[ ]	[ ]
20.	... do not often "crash" when student gives an unexpected response (for example, presses the ESCAPE key).	[ ]	[ ]	[ ]	[ ]	[ ]

21. ... are primarily (check all that apply):

[ ] Remedial basic skills activities
[ ] Normal developmental activities
[ ] Enrichment activities
[ ] Don't know

I need help in . . . .

22. ... integrating CAI program contents with related classroom activities. [ ] Yes [ ] No

23. ... utilizing the Computer-Managed Instruction features such as testing, placing, keeping records, and prescribing appropriate lessons or instructional strategies. [ ] Yes [ ] No

24. ... (other; please specify) _____

EFFECTIVENESS RATINGS

Instructions. Check the box that best represents the effectiveness of the following items.

		Very Ineffective				Very Effective
		1	2	3	4	5
25.	The training I received in preparation to use the CAI Network programs.	[ ]	[ ]	[ ]	[ ]	[ ]
26.	The microcomputer hardware used to present the CAI.	[ ]	[ ]	[ ]	[ ]	[ ]
27.	The CAI instructional software ("courseware").	[ ]	[ ]	[ ]	[ ]	[ ]